

# Presentation

May 20, 2025

## 1 Leavitt Law Calibration: Visualization

### 1.1 Dataset selection

Edit 'lvtlaw/a\_utils.py' file for selecting preferred dataset, then execute following cell to initiate the calibration process. Results will be stored in data/output directories.

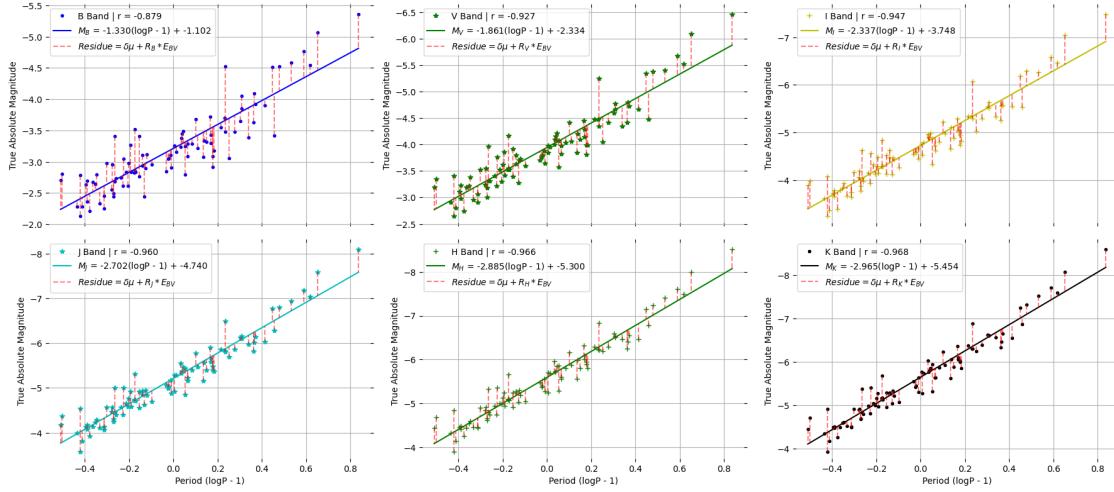
```
[ ]: !python3 main.py
```

```
[1]: import pandas as pd, matplotlib.pyplot as plt
from lvtlaw.a_utils import k, wes_show, dis_flag, mag, del_mu, R, regression
from lvtlaw.a_utils import pr_value, col_dot, col_lin, save, image_directories, ↴
    col_lin, data_out, process_step
from visuals.dataload import transformation, PLWcorrection, del_del, pick_star, ↴
    correction_red_mu_stars, result
from visuals.plrelation import plotPL, plotPW, plotPL6, plotPW6
from visuals.deldel import plotdeldel
from visuals.reddening import plotstar
from visuals.result import resultPL6, print_PL
image_directories()
dis = dis_flag[0]
col = wes_show[0]
absolute, extinction, tabsolute, wesenheit = transformation()
n= len(absolute)
_, res, reg, pre = PLWcorrection()
dpre_S, dres_S, dmc_S, dSM = del_del()
new_M, result_reg, c, d = result()
#print('Make changes from a_utils.py file. \n\nDataset: %i / Distance Method: ↴
    %s / Wesenheit Index: '%(k, dis), wes_show)
```

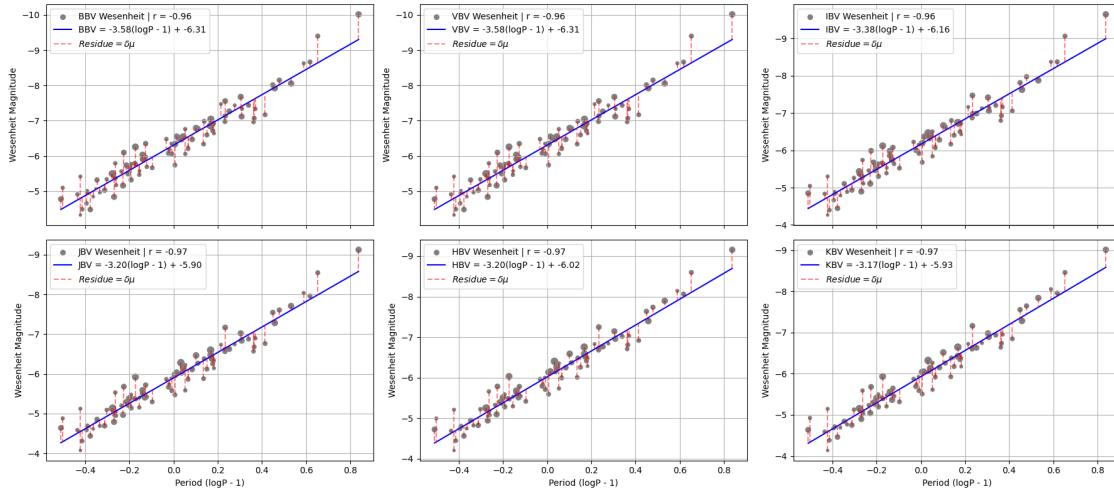
## 2 PL and PW relations

```
[8]: plotPL6(tabsolute, res, reg, pre, dis, s=1)
for col in wes_show:
    plotPW6(wesenheit, col, res, reg, pre, dis, s=1)
```

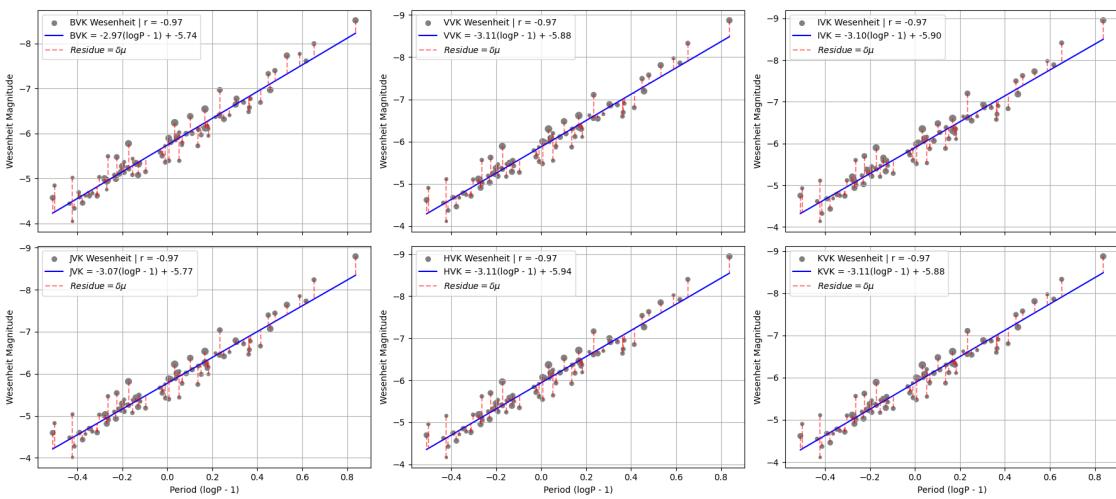
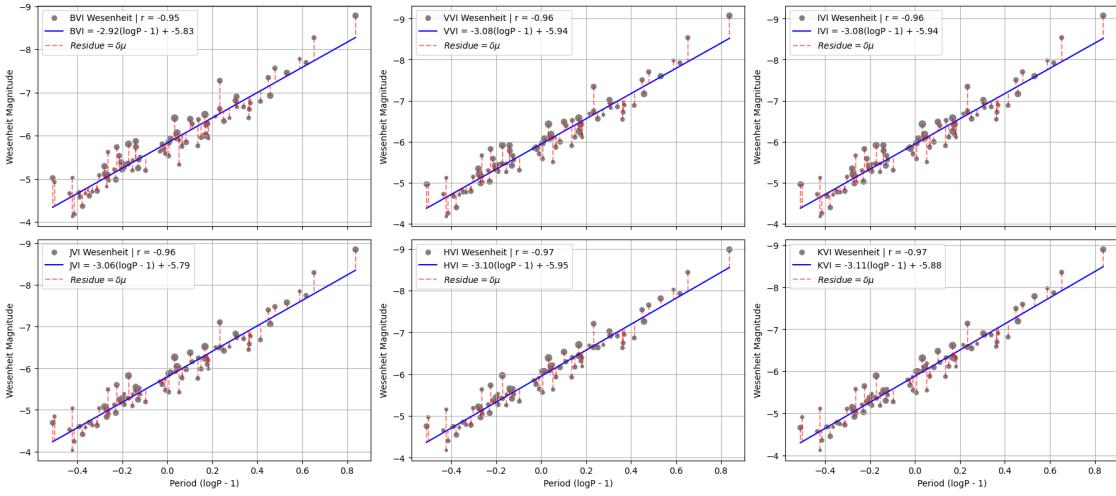
./data/output/9\_plots/2\_PLPW/94\_BVIJHK\_g.png



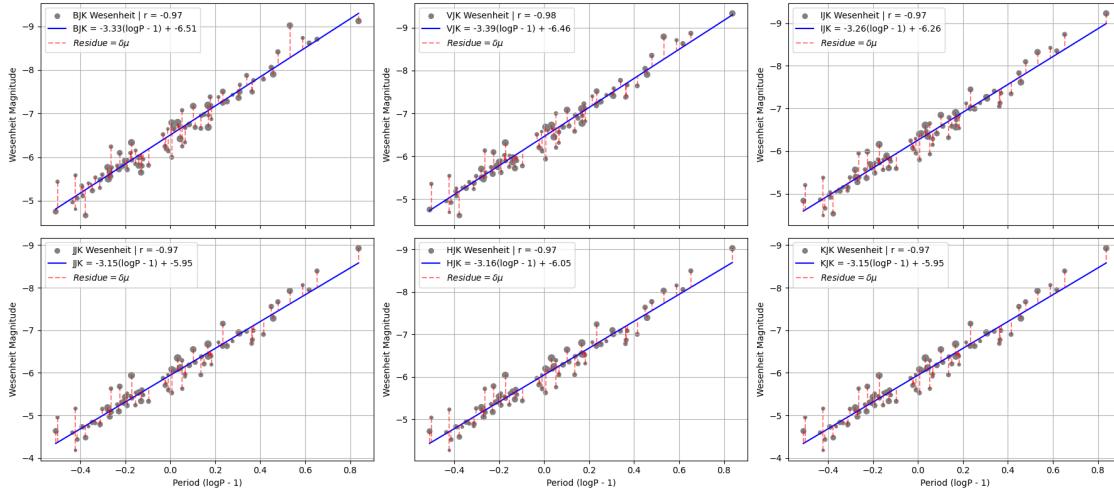
./data/output/9\_plots/2\_PLPW/94\_BV\_BVIJHK\_g.png



./data/output/9\_plots/2\_PLPW/94\_VI\_BVIJHK\_g.png



./data/output/9\_plots/2\_PLPW/94\_JK\_BVIJHK\_g.png

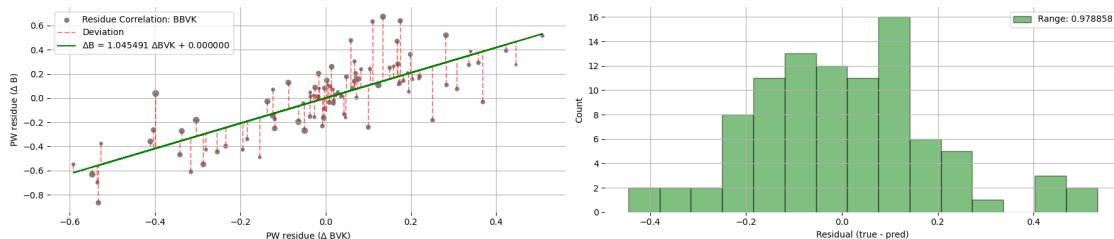


### 3 Residue - Residue Plot

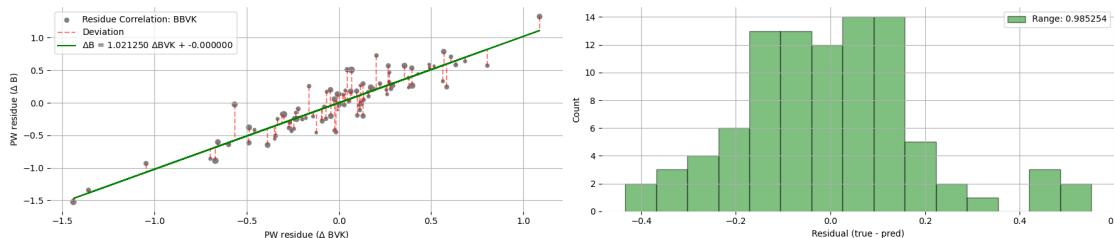
```
[4]: print('Residue - Residue Plot')
# Shown only for VK based Wesenheit
for i in range(0,6):
    plotdeldel(i, tabsolute, 'VK', res, dSM, dis, s=1)
    plotdeldel(i, tabsolute, 'VK', res, dSM, '_i', s=1)
```

Residue - Residue Plot

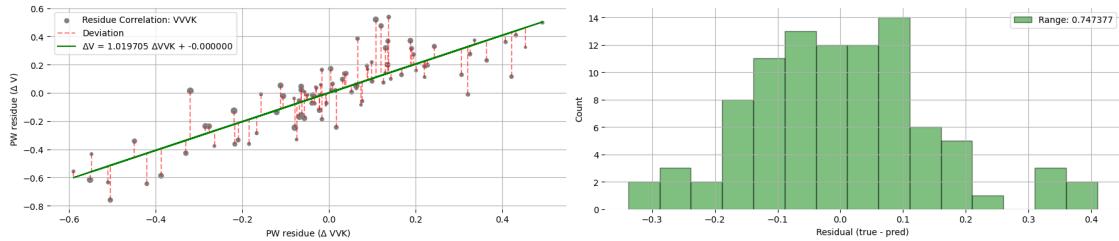
94\_del\_VK\_B\_g



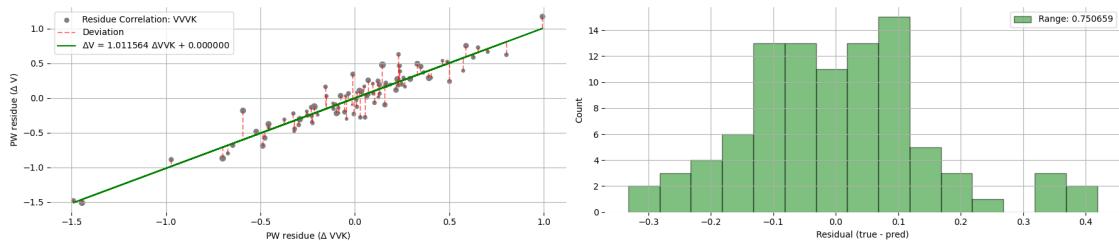
94\_del\_VK\_B\_i



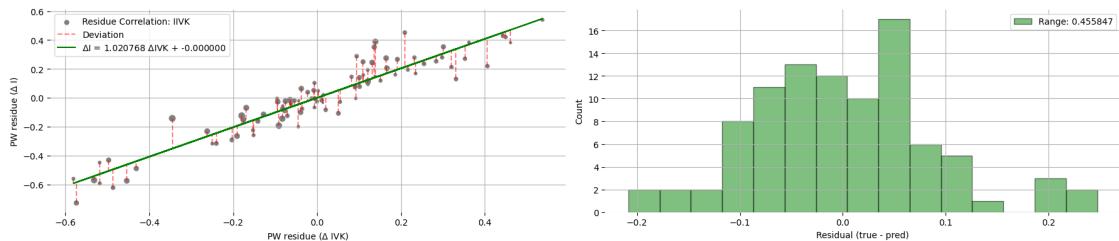
## 94\_del\_VK\_V\_g



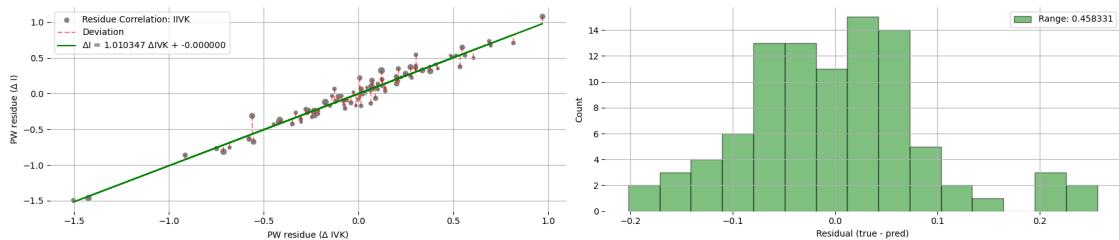
## 94\_del\_VK\_V\_i



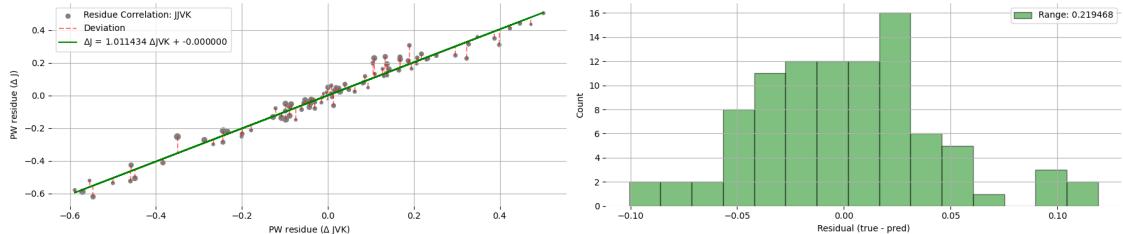
## 94\_del\_VK\_I\_g



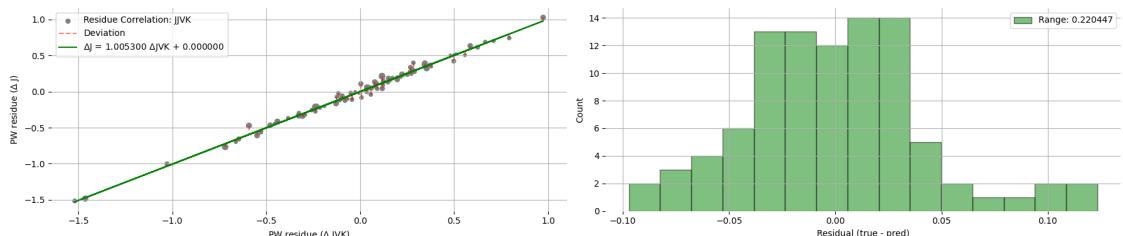
## 94\_del\_VK\_I\_i



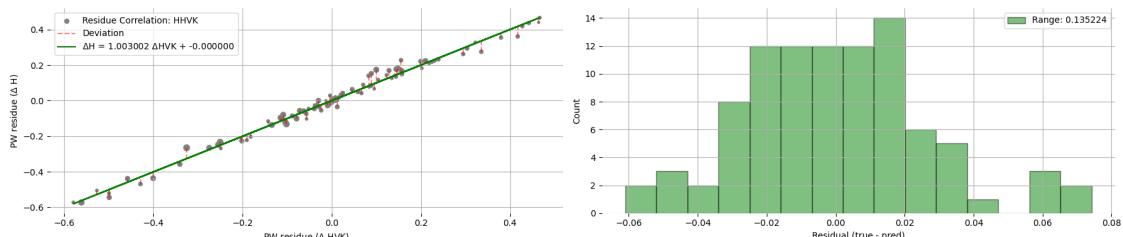
## 94\_del\_VK\_J\_g



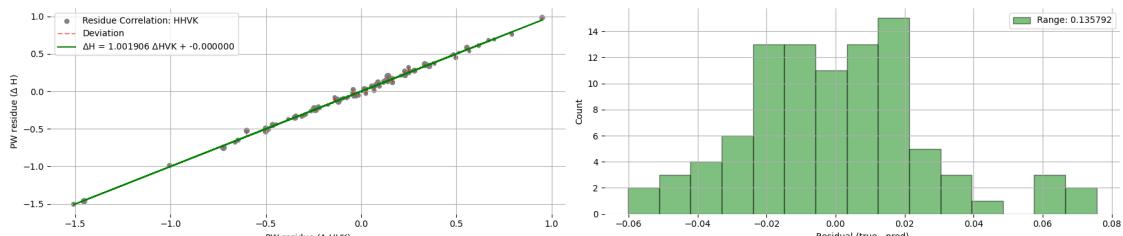
## 94\_del\_VK\_J\_i



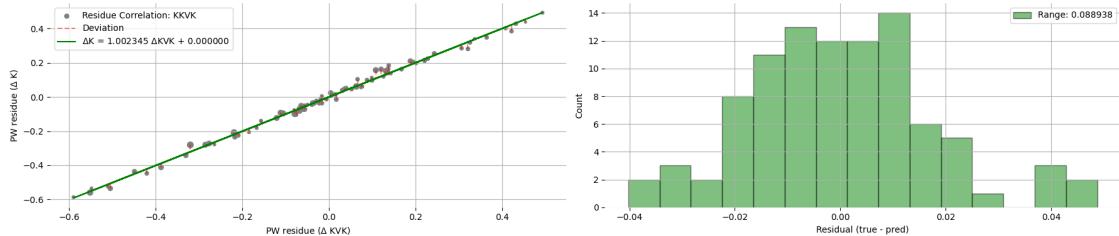
## 94\_del\_VK\_H\_g



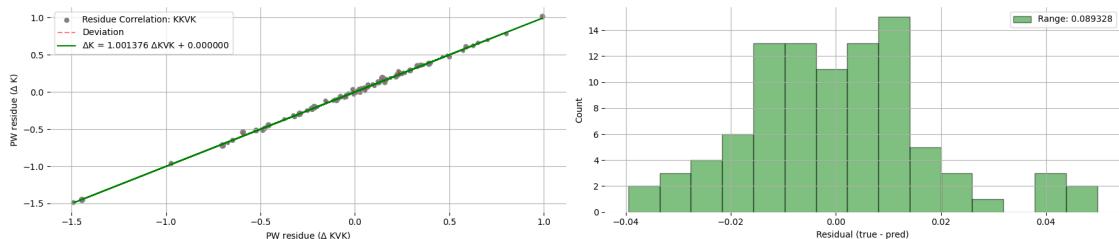
## 94\_del\_VK\_H\_i



## 94\_del\_VK\_K\_g



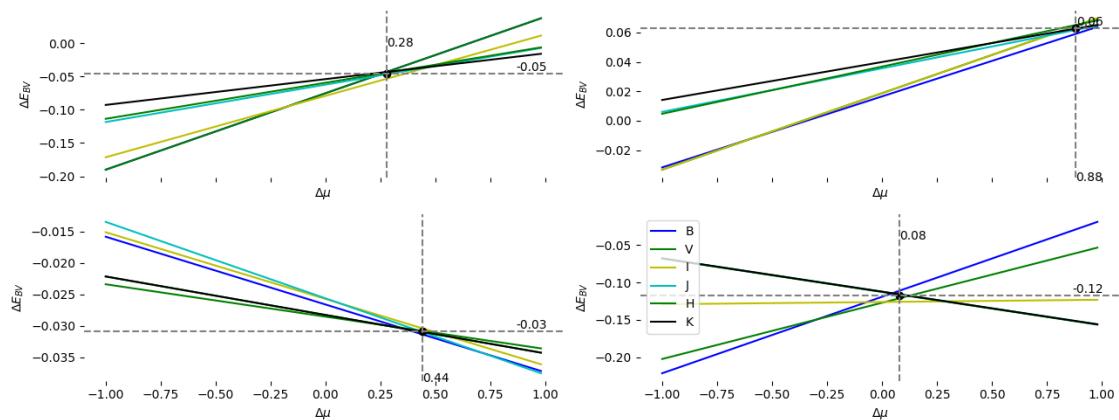
## 94\_del\_VK\_K\_i



## 4 Decoupling Distance Reddening Systematic Errors

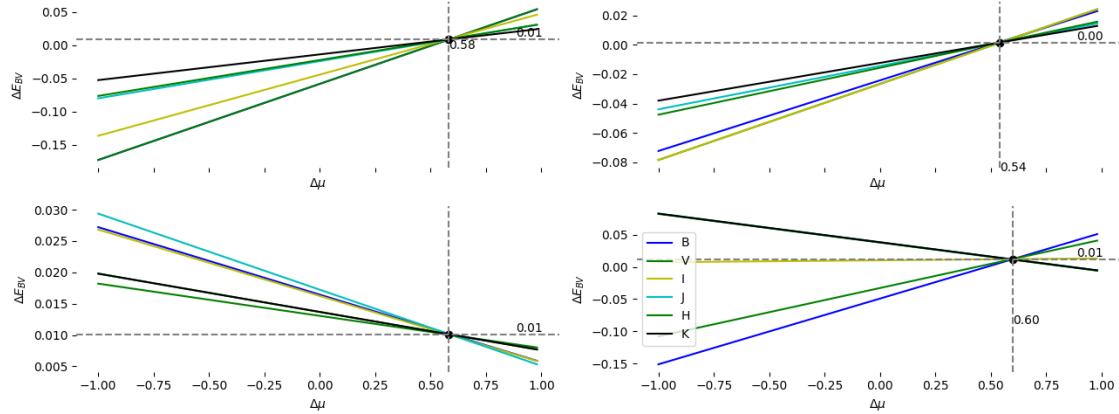
```
[3]: print('Deriving corrections for colors: ', wes_show)
for i in range(0,n):
    plotstar(i, wes_show, dis,s=1)
```

94\_0\_star\_JK\_g  
./data/output/9\_plots/6\_rms/94\_0\_star\_JK\_g.png



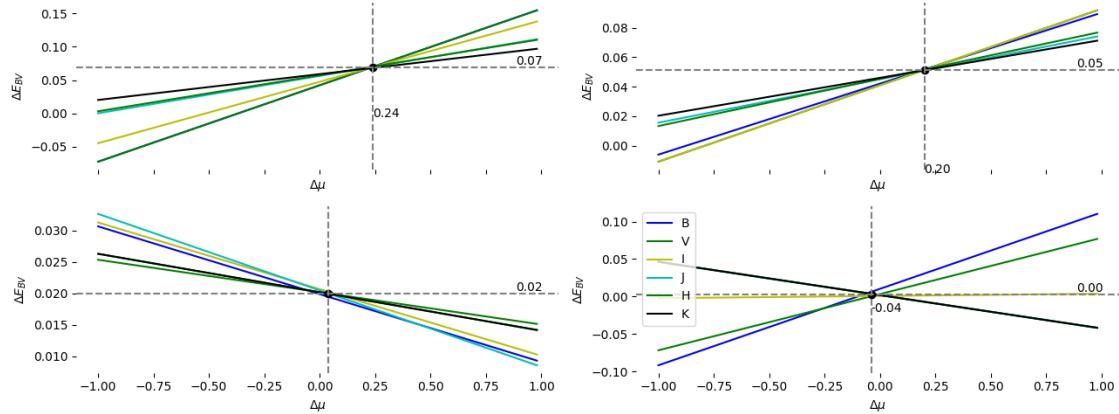
94\_1\_star\_JK\_g

./data/output/9\_plots/6\_rms/94\_1\_star\_JK\_g.png



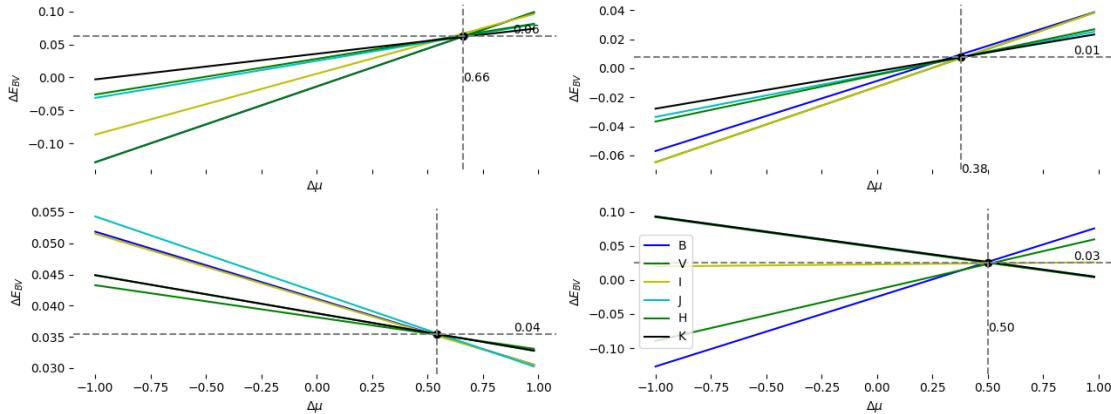
94\_2\_star\_JK\_g

./data/output/9\_plots/6\_rms/94\_2\_star\_JK\_g.png

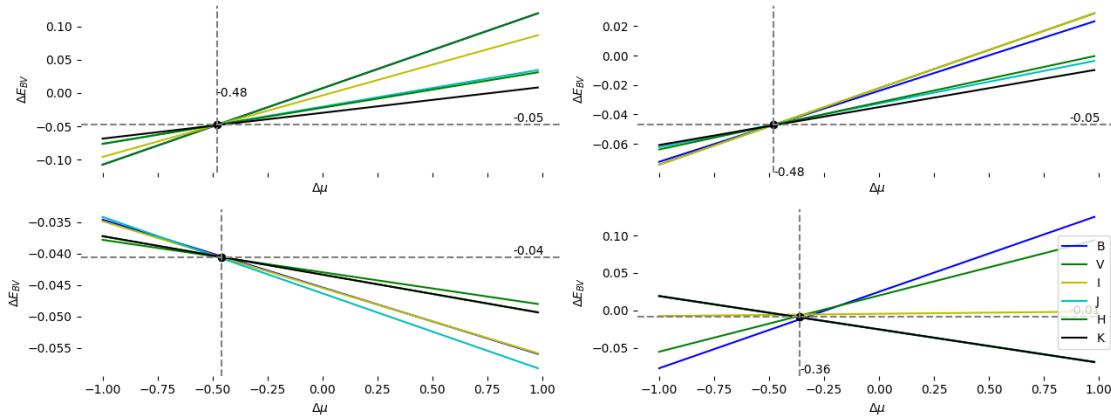


94\_3\_star\_JK\_g

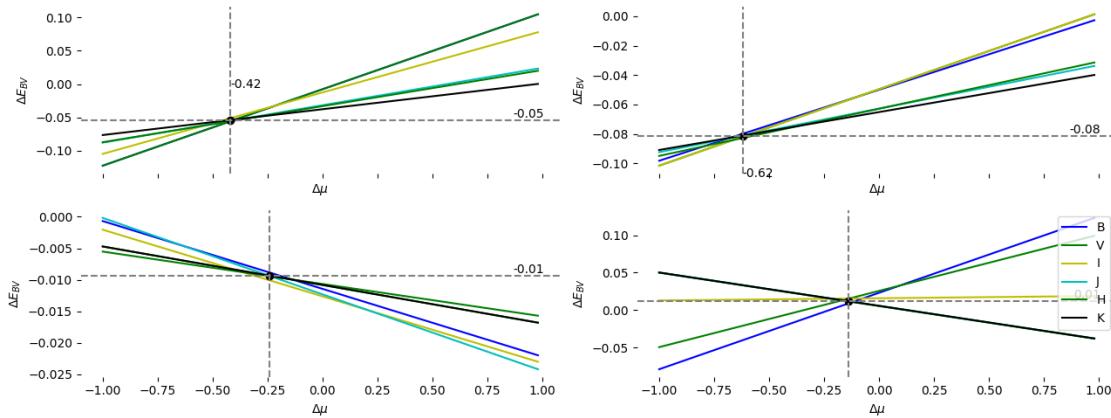
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94\_4\_star\_JK\_g  
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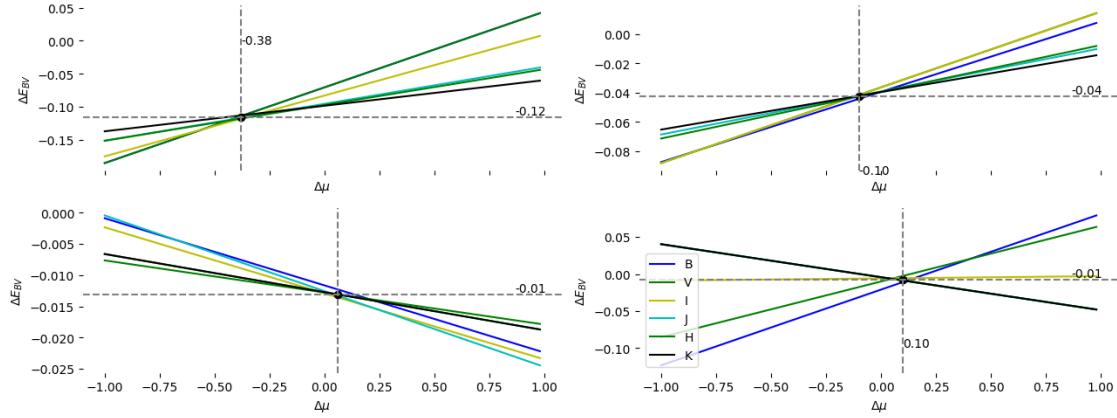


94\_5\_star\_JK\_g  
`./data/output/9_plots/6_rms/94_5_star_JK_g.png`



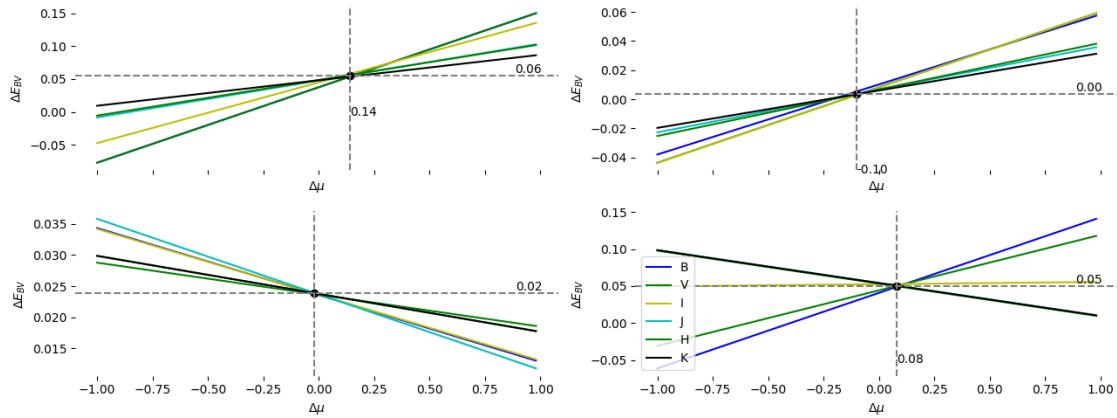
94\_6\_star\_JK\_g

./data/output/9\_plots/6\_rms/94\_6\_star\_JK\_g.png



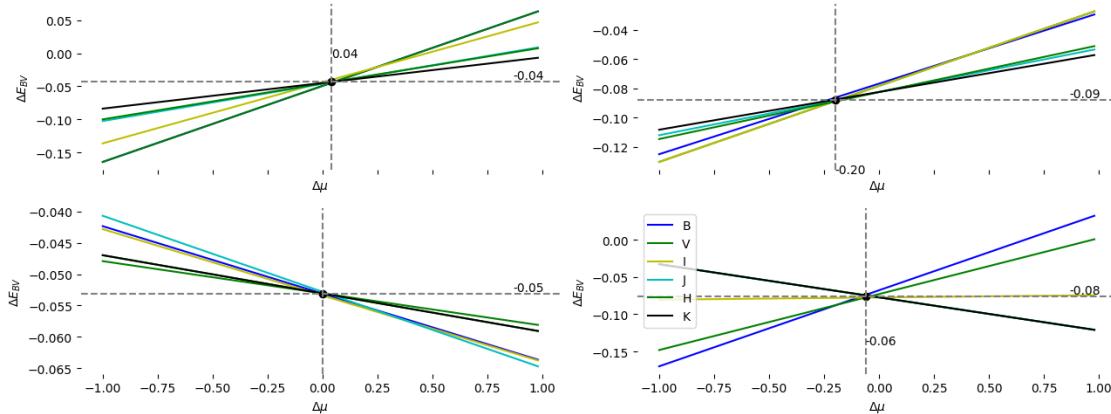
94\_7\_star\_JK\_g

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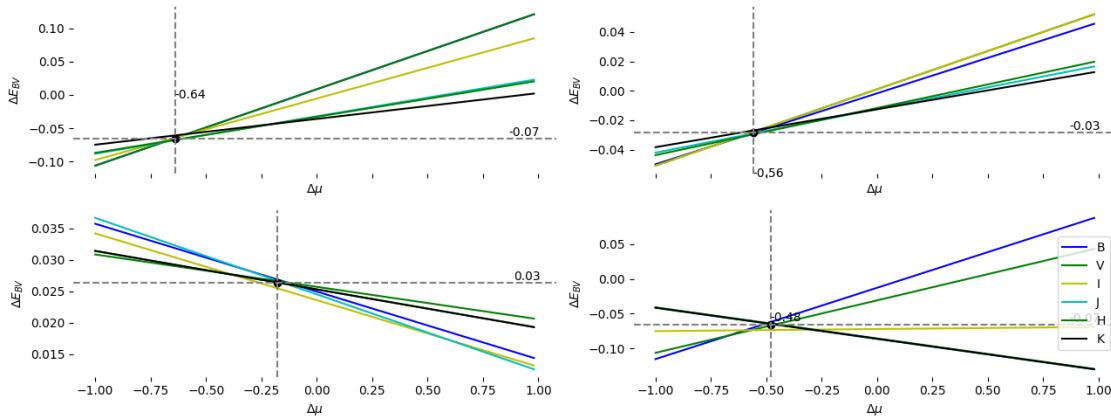


94\_8\_star\_JK\_g

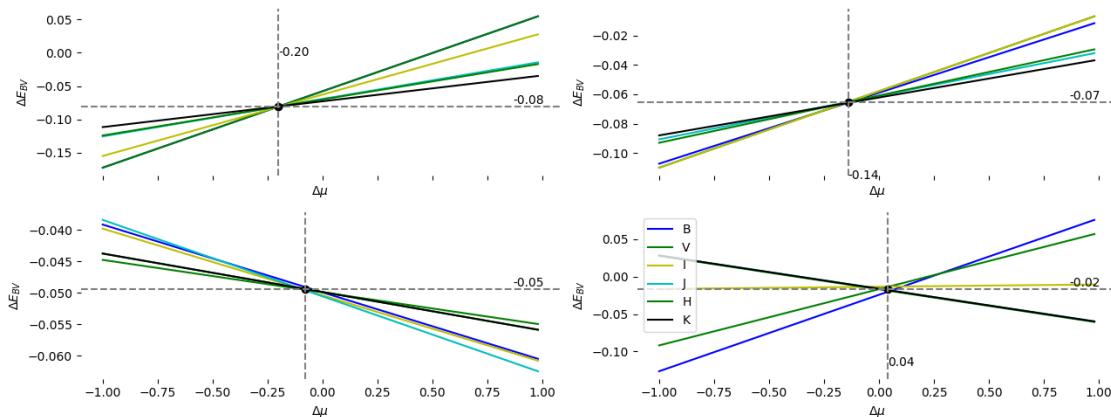
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94\_9\_star\_JK\_g  
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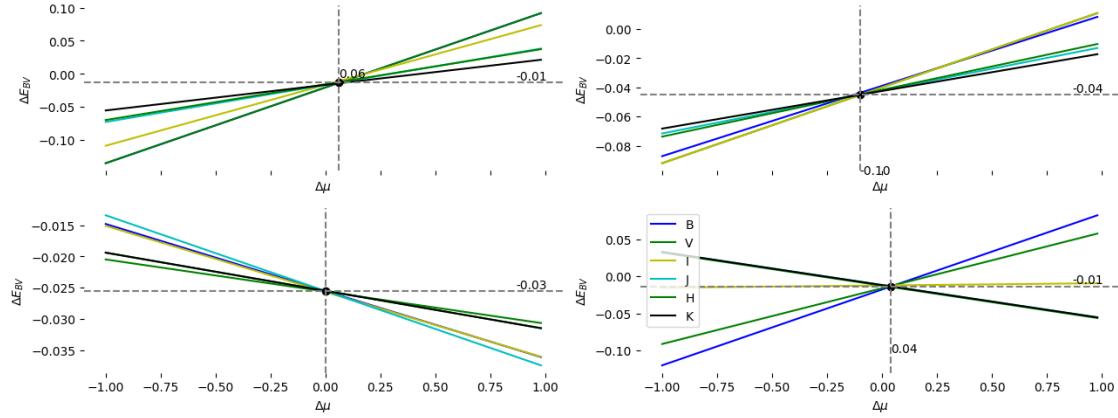


94\_10\_star\_JK\_g  
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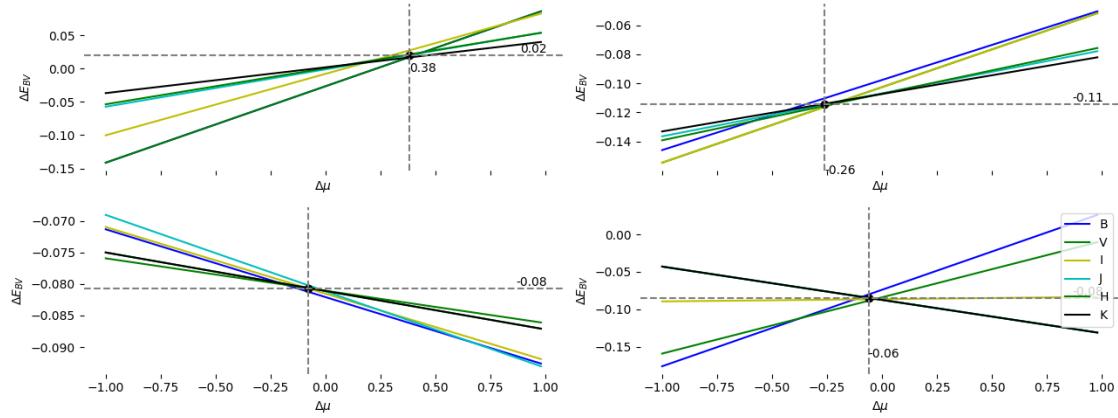
94\_11\_star\_JK\_g

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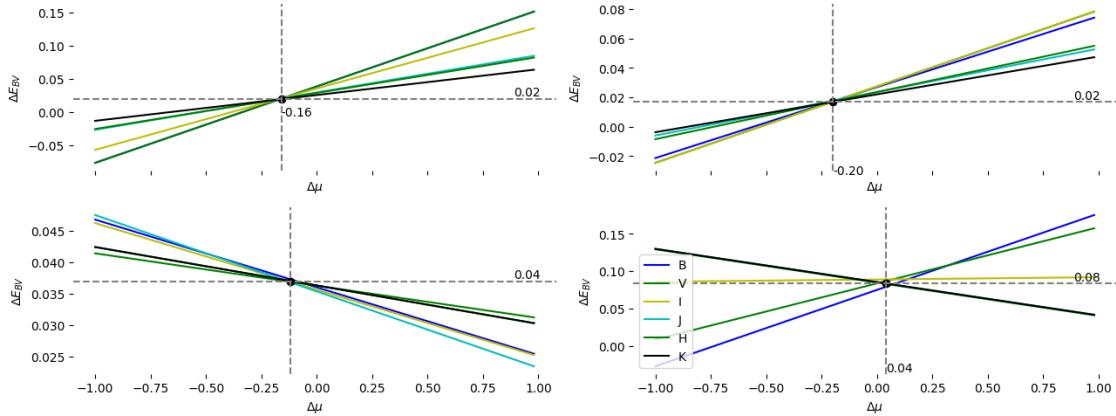
94\_12\_star\_JK\_g

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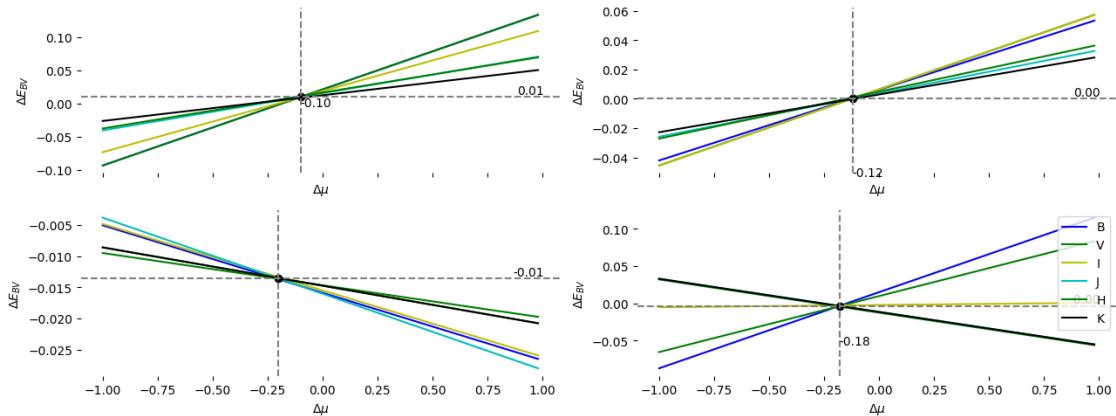


94\_13\_star\_JK\_g

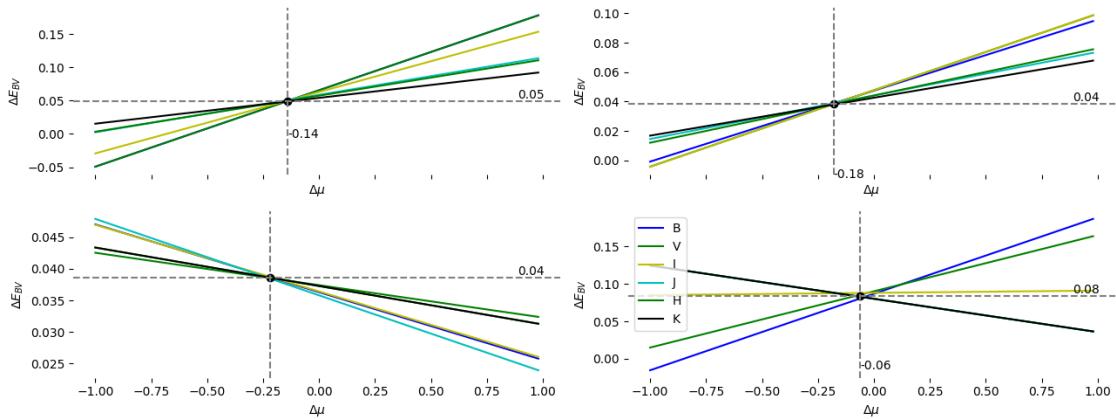
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94\_14\_star\_JK\_g  
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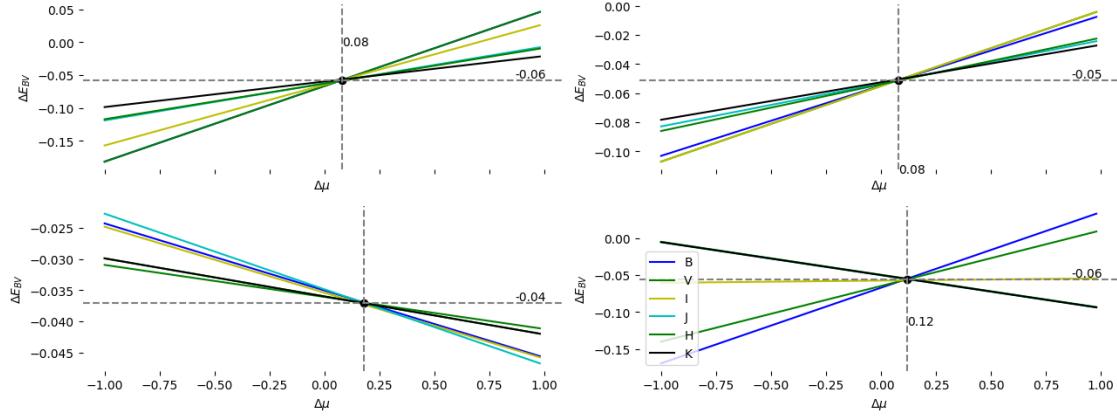


94\_15\_star\_JK\_g  
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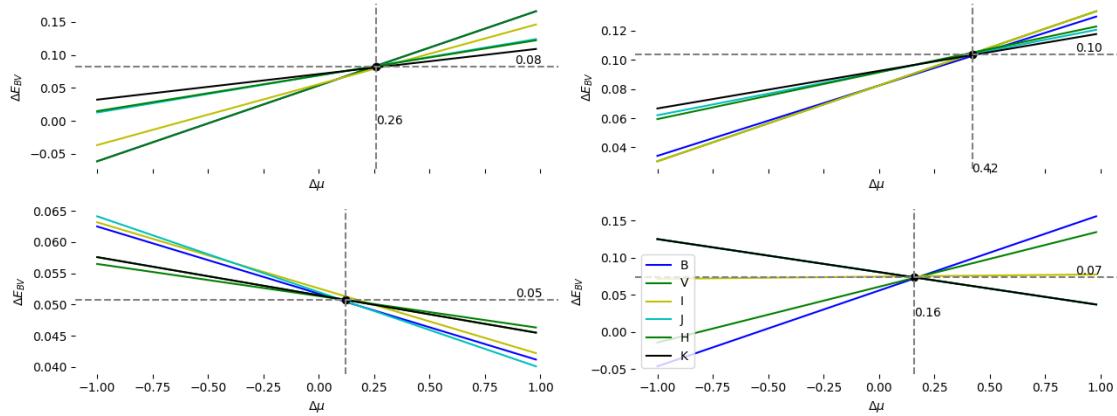
94\_16\_star\_JK\_g

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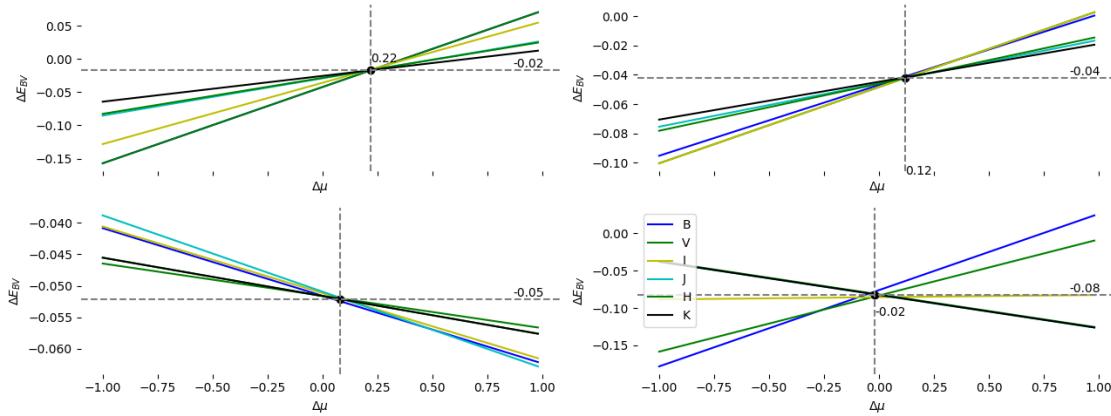
94\_17\_star\_JK\_g

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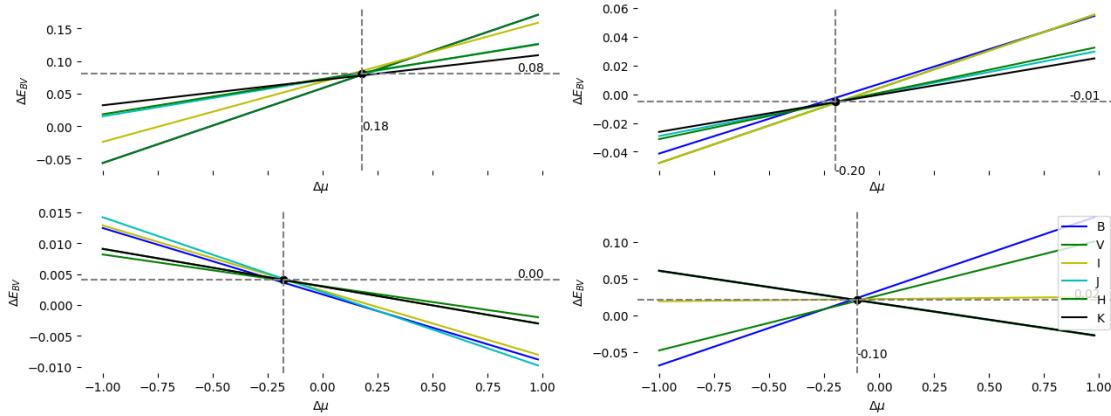


94\_18\_star\_JK\_g

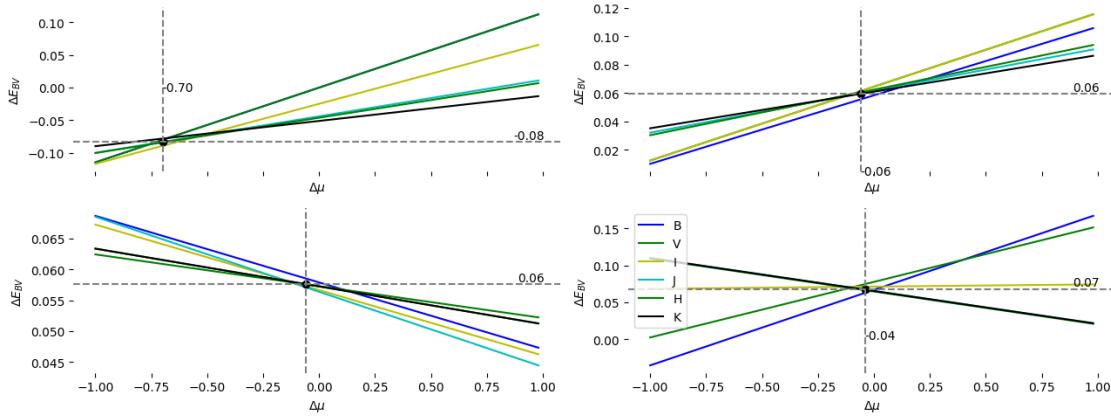
./data/output/9\_plots/6\_rms/94\_18\_star\_JK\_g.png



94\_19\_star\_JK\_g  
`./data/output/9_plots/6_rms/94_19_star_JK_g.png`

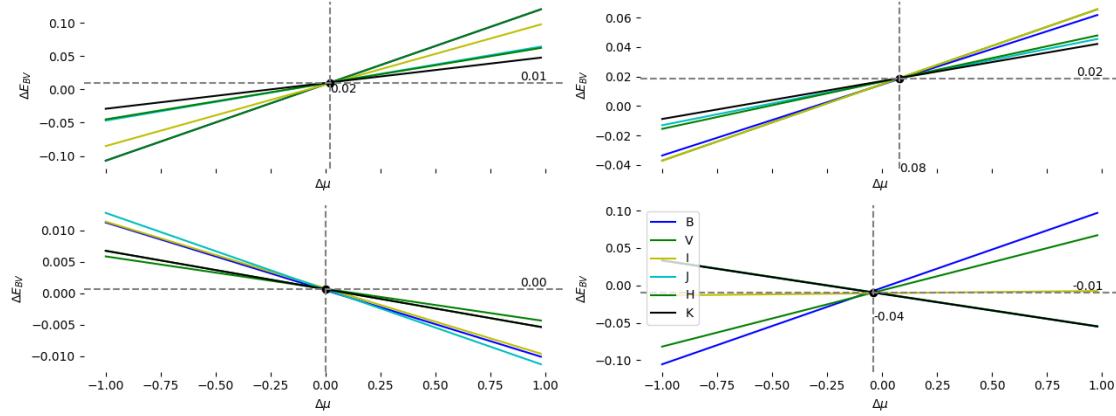


94\_20\_star\_JK\_g  
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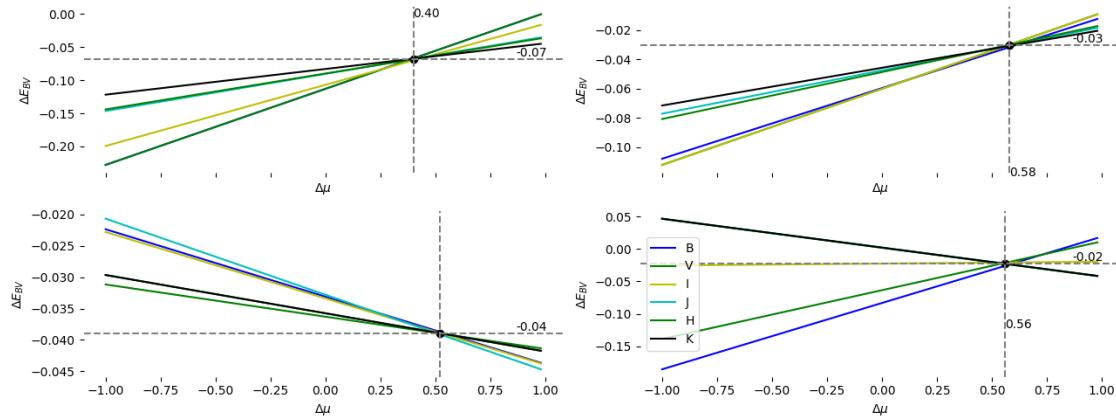
94\_21\_star\_JK\_g

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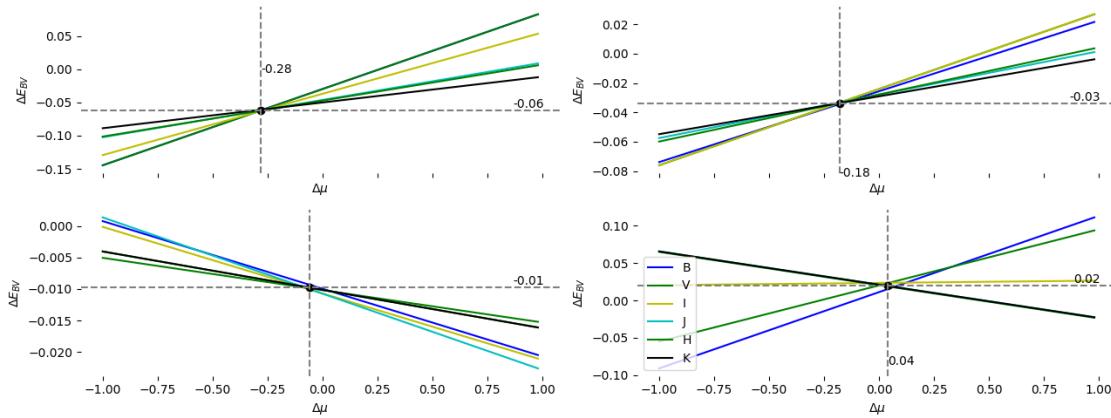
94\_22\_star\_JK\_g

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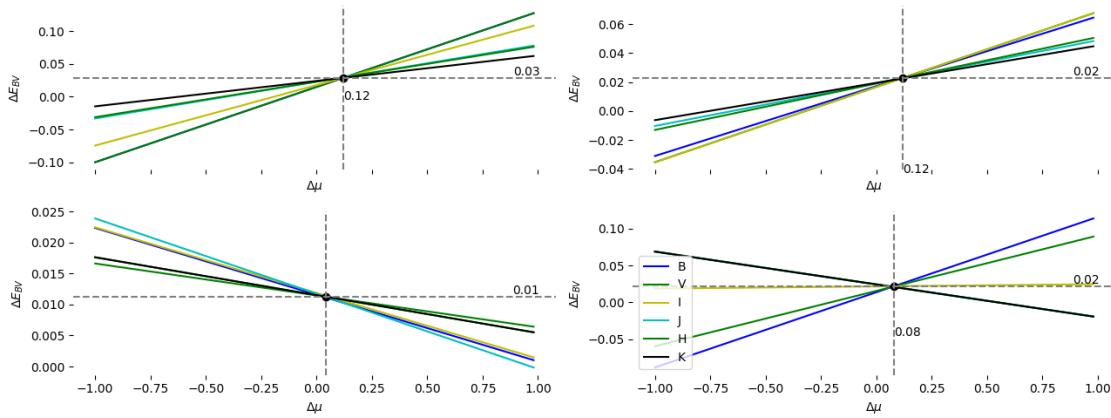


94\_23\_star\_JK\_g

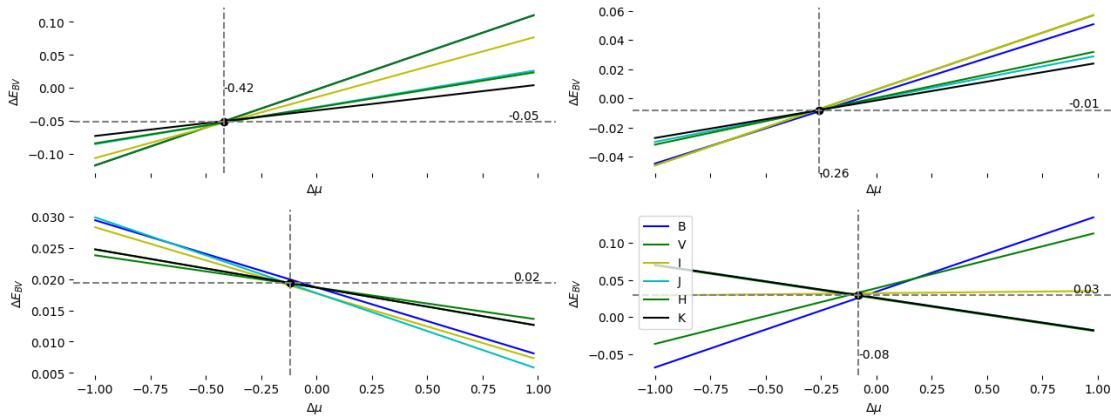
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94\_24\_star\_JK\_g  
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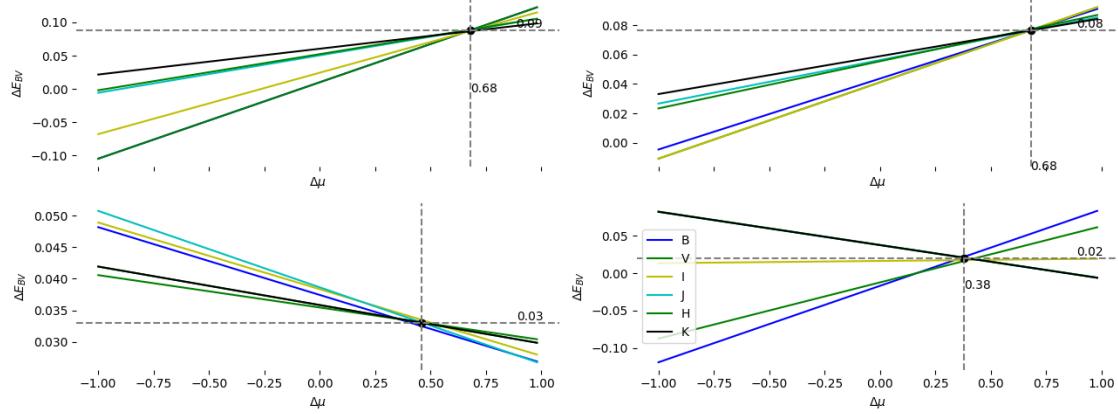


94\_25\_star\_JK\_g  
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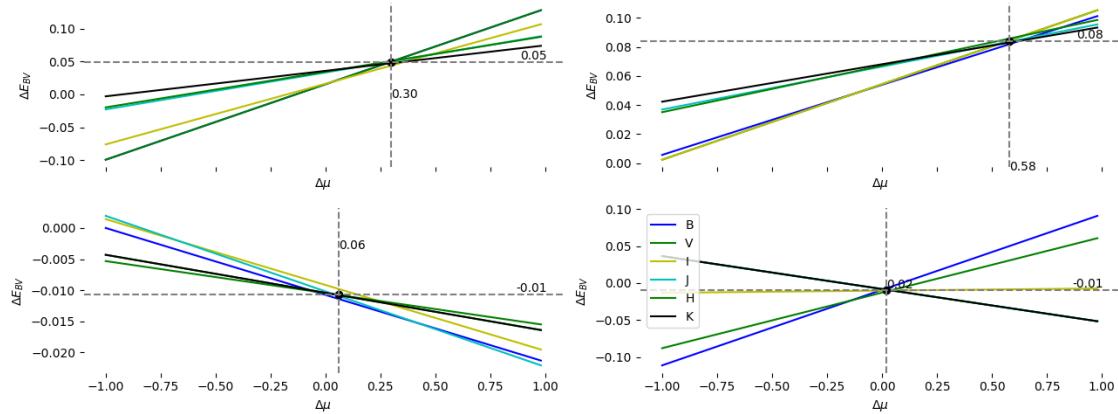
94\_26\_star\_JK\_g

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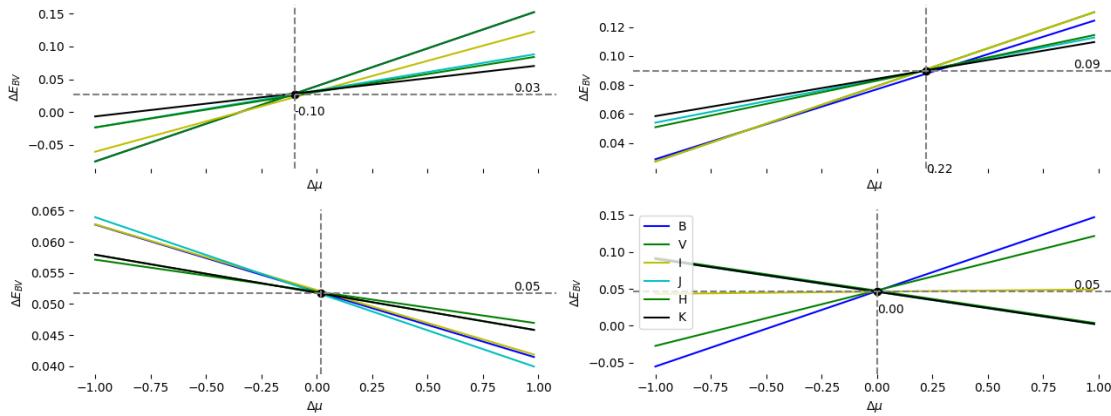
94\_27\_star\_JK\_g

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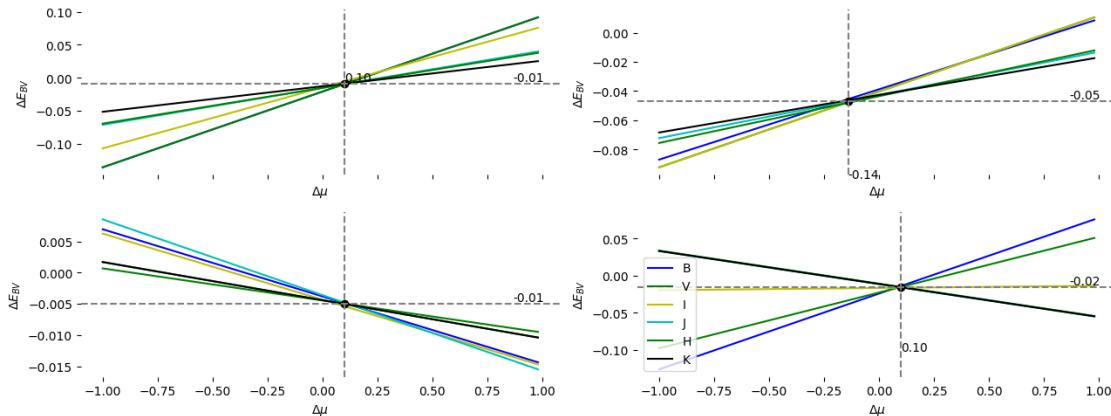


94\_28\_star\_JK\_g

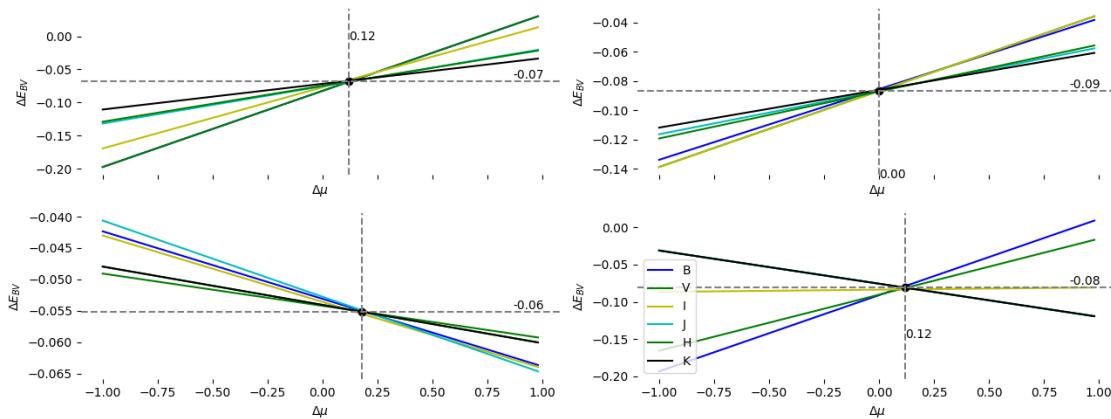
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94\_29\_star\_JK\_g  
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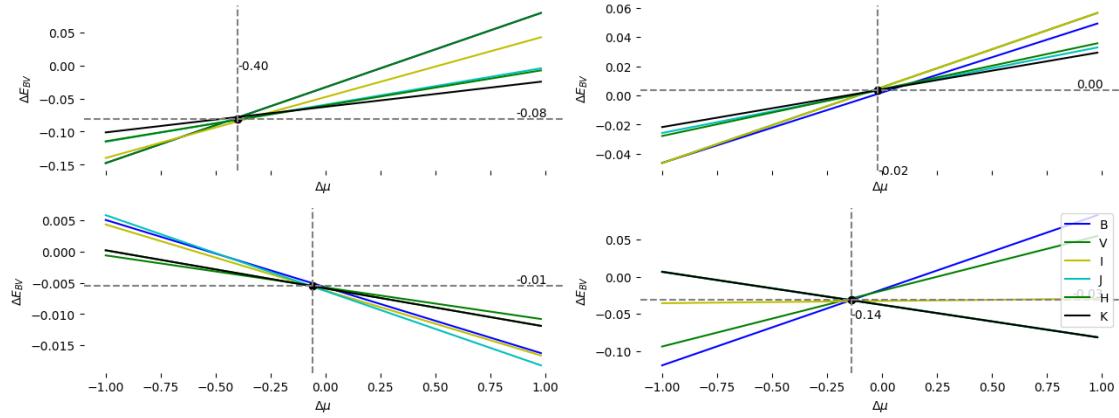


94\_30\_star\_JK\_g  
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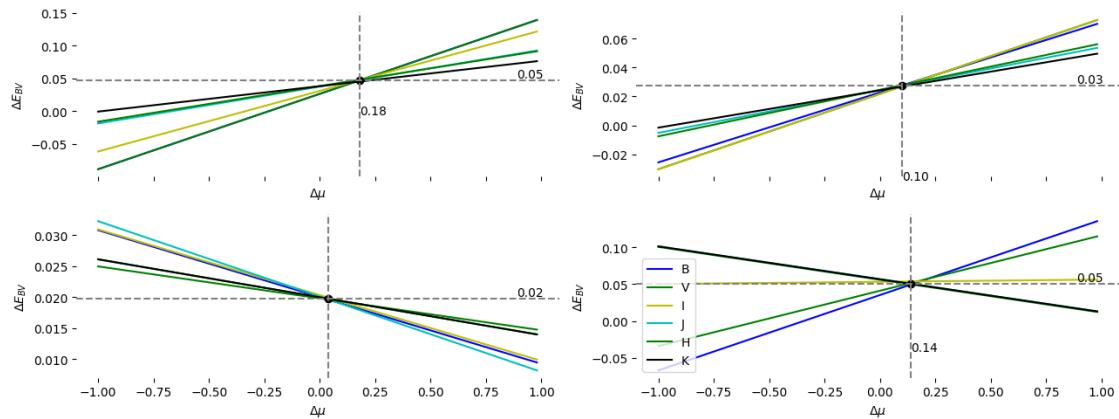
94\_31\_star\_JK\_g

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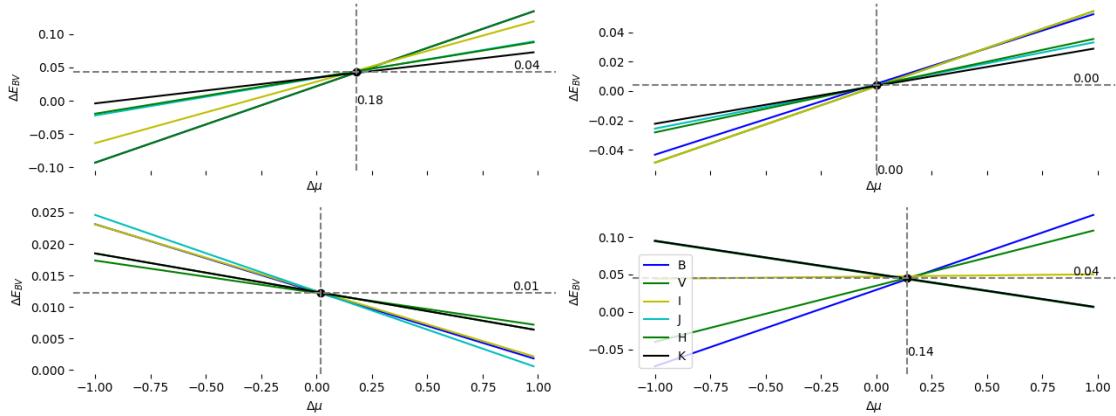
94\_32\_star\_JK\_g

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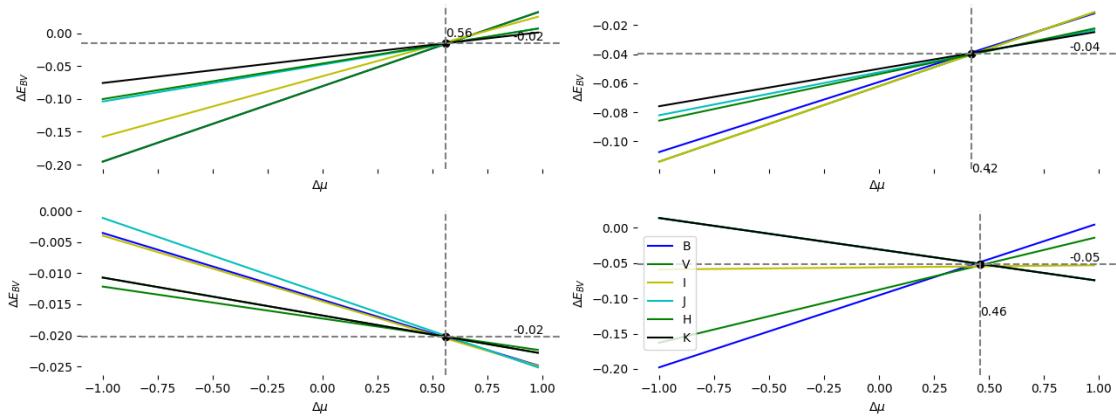


94\_33\_star\_JK\_g

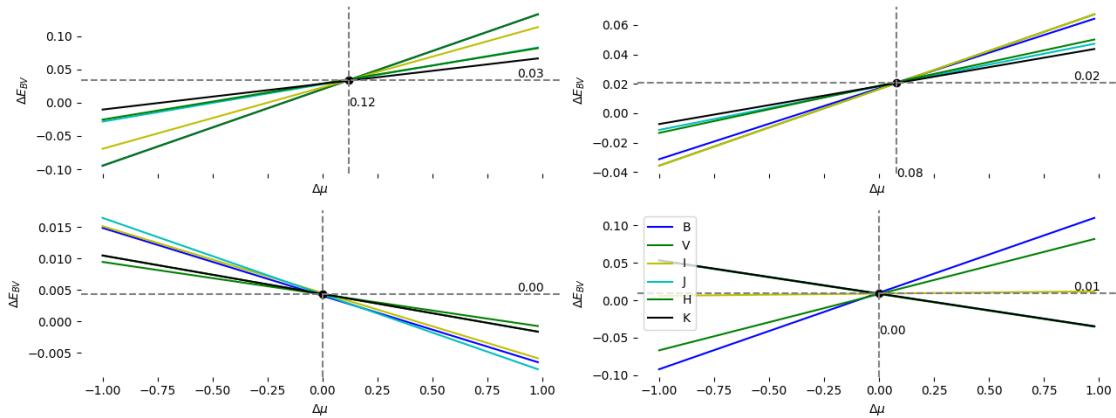
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94\_34\_star\_JK\_g  
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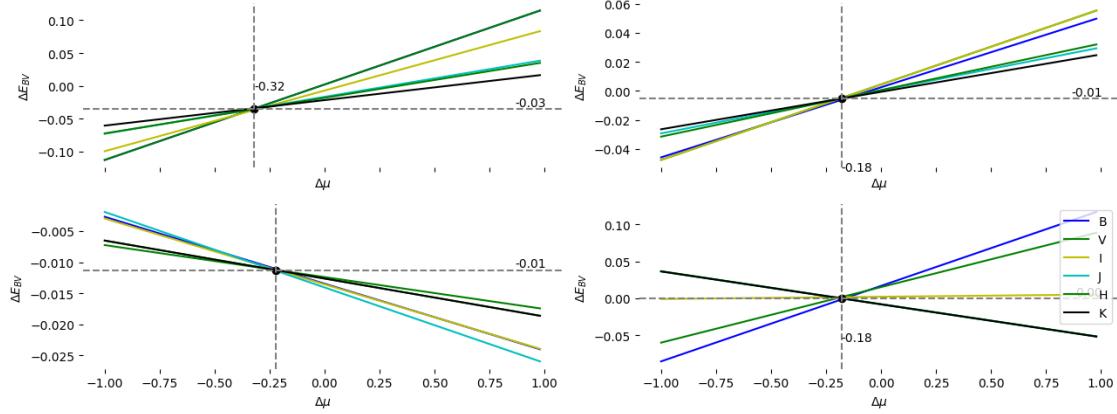


94\_35\_star\_JK\_g  
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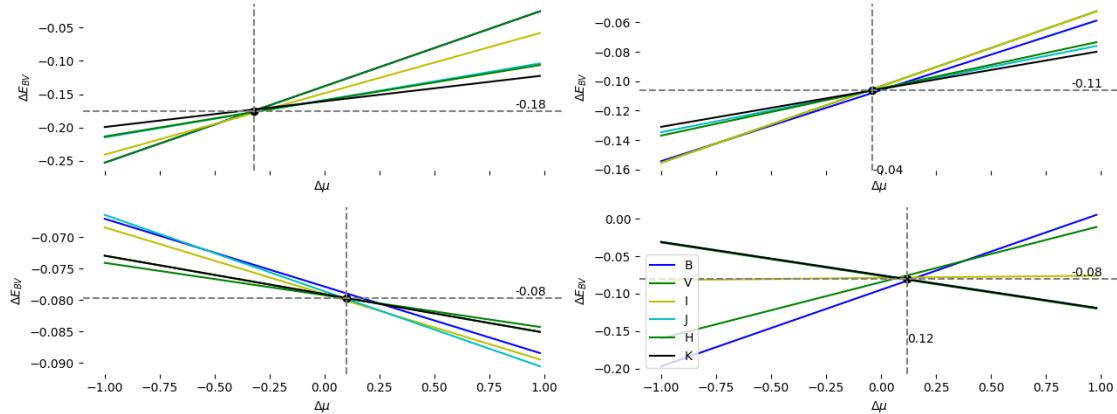
94\_36\_star\_JK\_g

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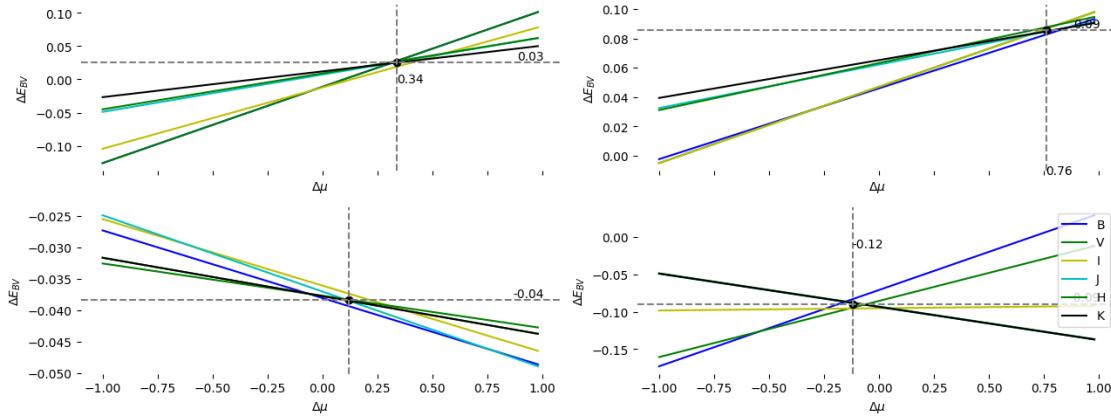
94\_37\_star\_JK\_g

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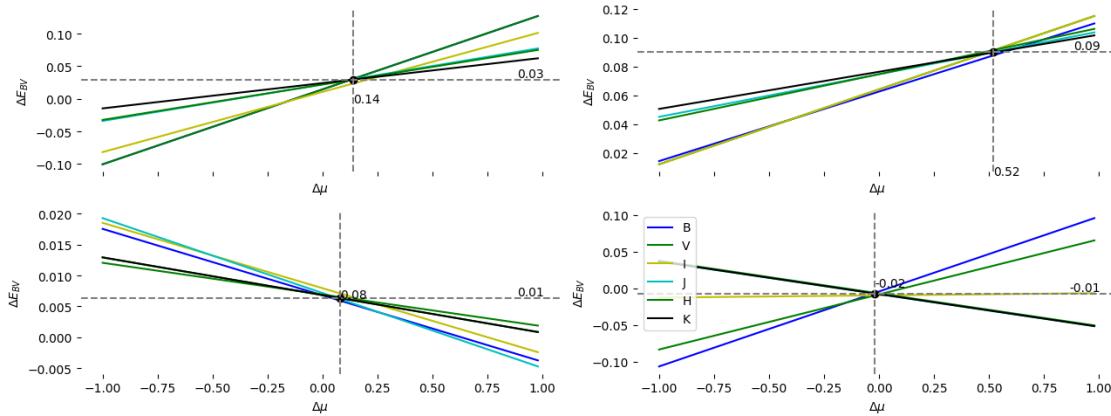


94\_38\_star\_JK\_g

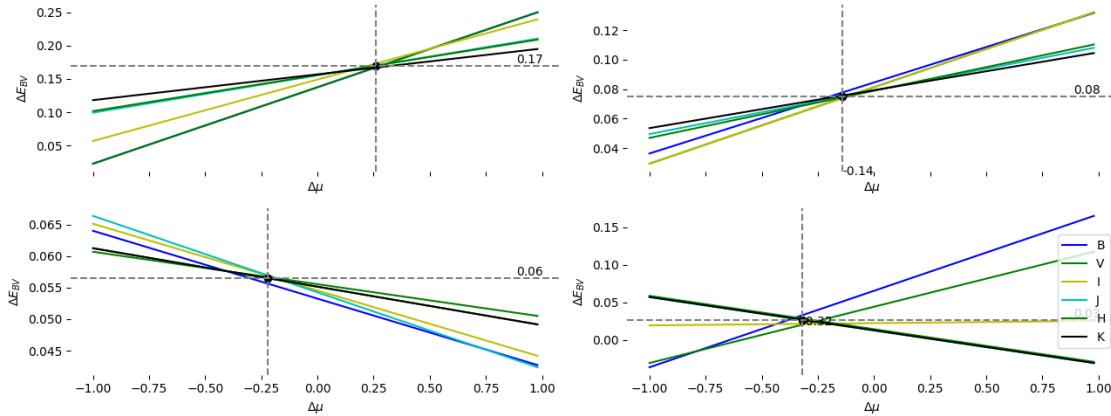
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94\_39\_star\_JK\_g  
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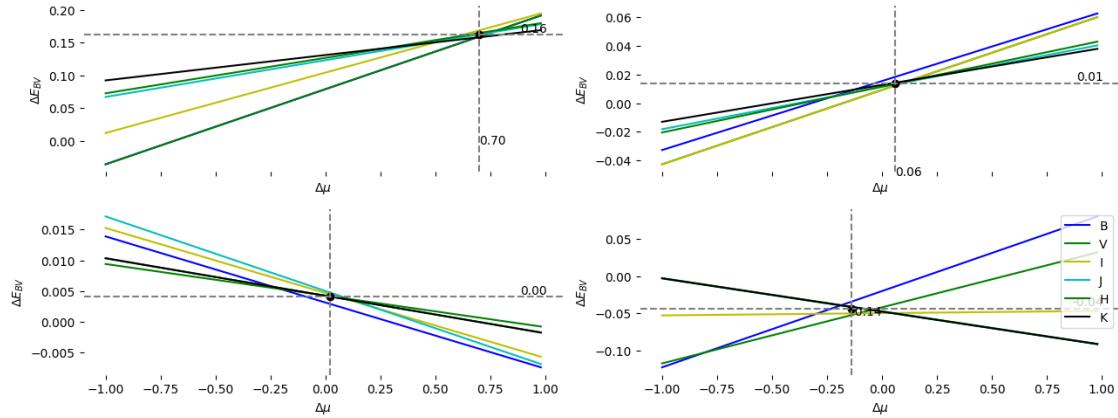


94\_40\_star\_JK\_g  
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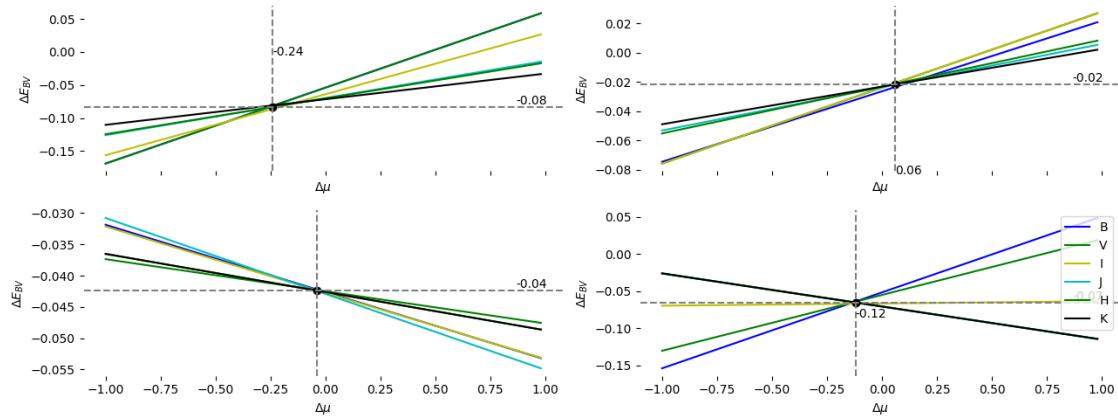
94\_41\_star\_JK\_g

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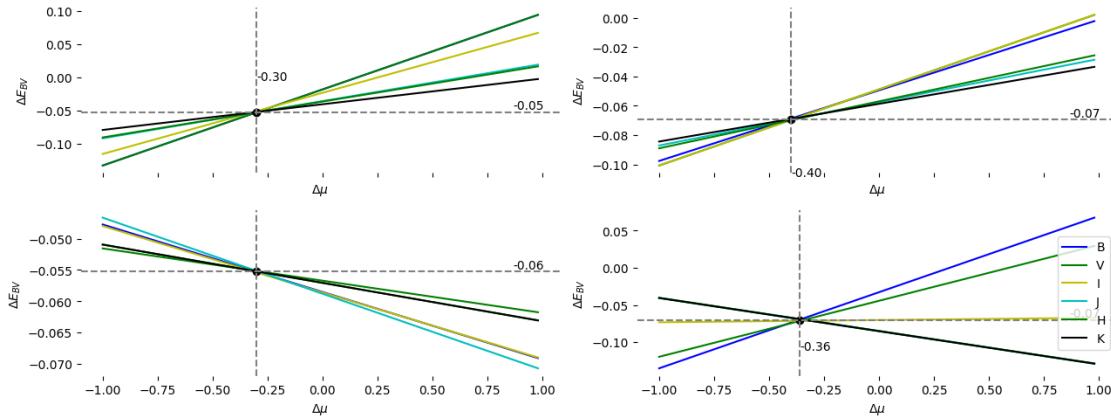
94\_42\_star\_JK\_g

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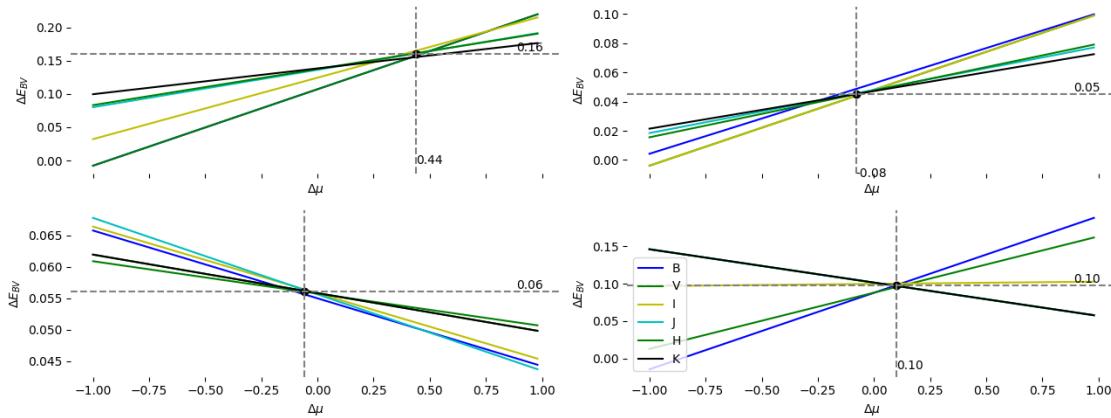


94\_43\_star\_JK\_g

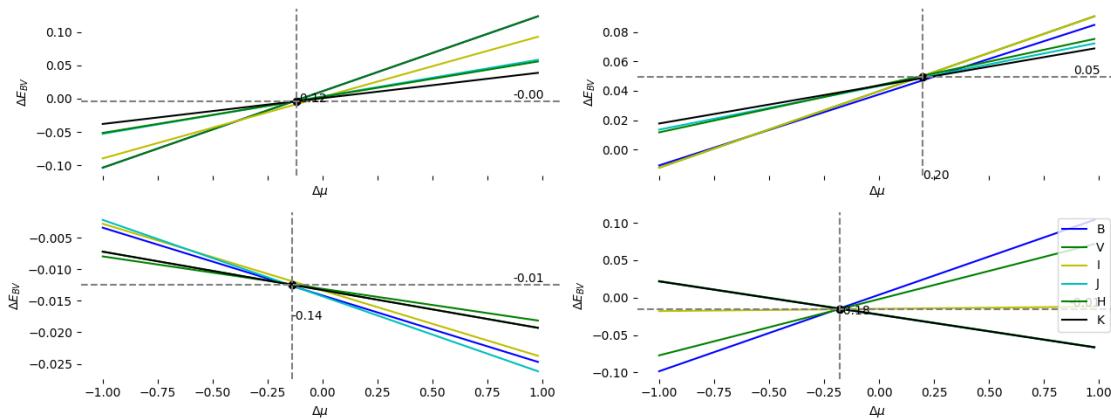
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94\_44\_star\_JK\_g  
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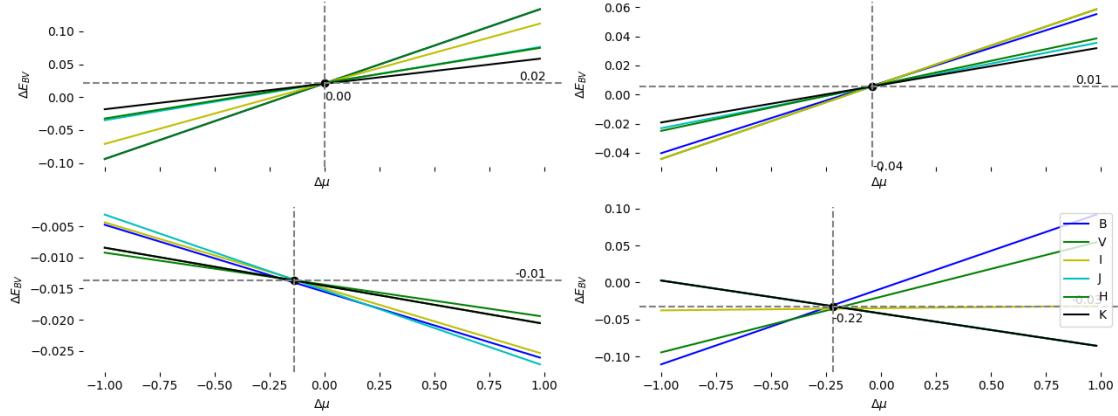


94\_45\_star\_JK\_g  
`./data/output/9_plots/6_rms/94_45_star_JK_g.png`



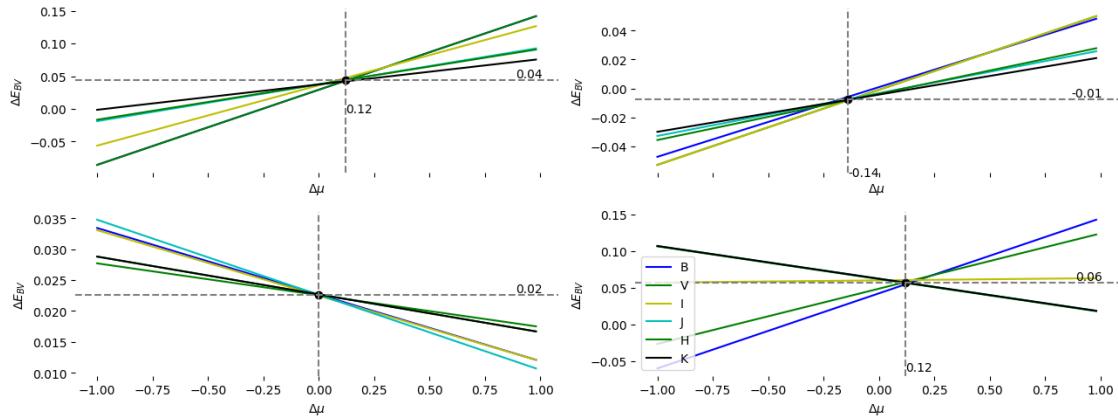
94\_46\_star\_JK\_g

./data/output/9\_plots/6\_rms/94\_46\_star\_JK\_g.png



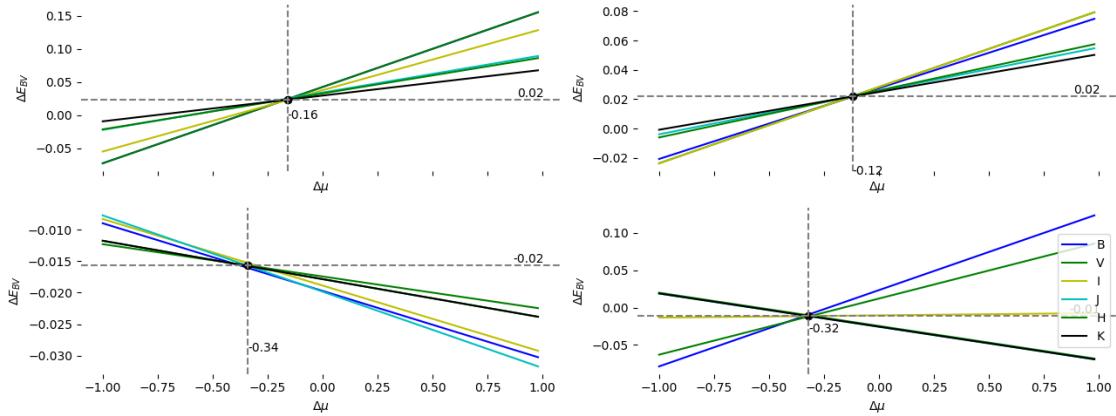
94\_47\_star\_JK\_g

./data/output/9\_plots/6\_rms/94\_47\_star\_JK\_g.png

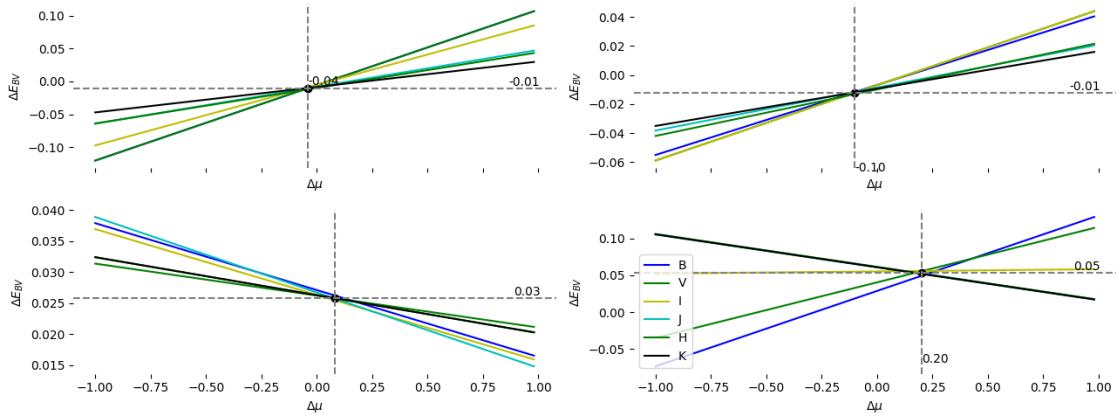


94\_48\_star\_JK\_g

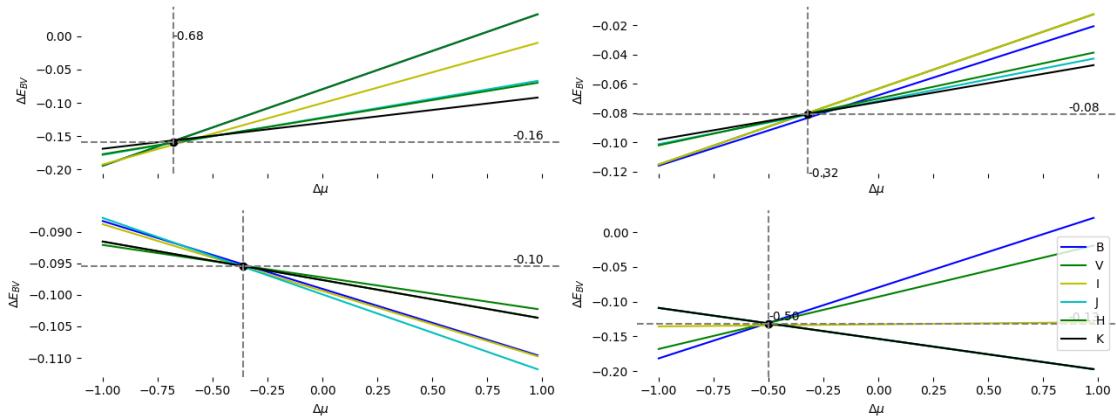
./data/output/9\_plots/6\_rms/94\_48\_star\_JK\_g.png



94\_49\_star\_JK\_g  
./data/output/9\_plots/6\_rms/94\_49\_star\_JK\_g.png

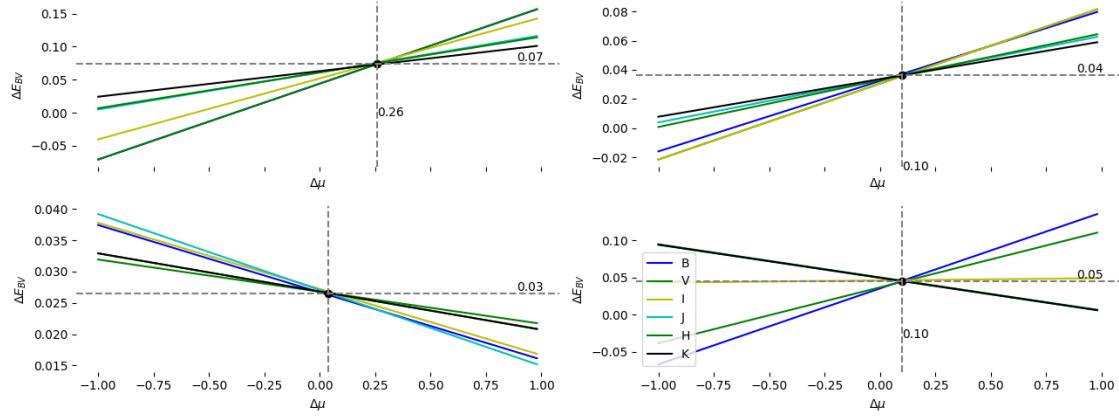


94\_50\_star\_JK\_g  
./data/output/9\_plots/6\_rms/94\_50\_star\_JK\_g.png



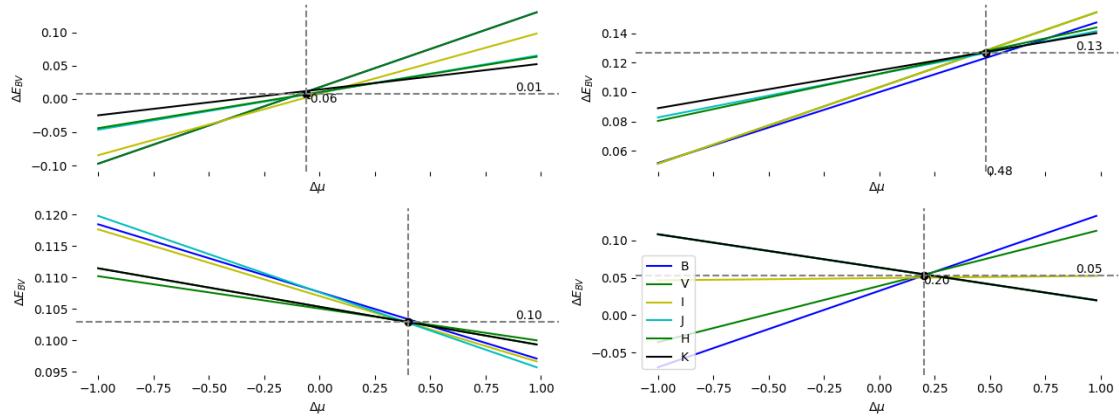
94\_51\_star\_JK\_g

./data/output/9\_plots/6\_rms/94\_51\_star\_JK\_g.png



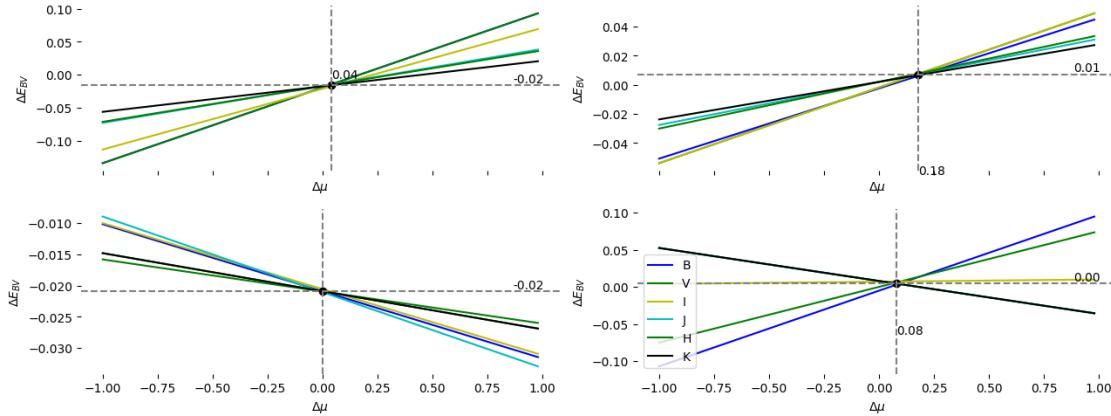
94\_52\_star\_JK\_g

./data/output/9\_plots/6\_rms/94\_52\_star\_JK\_g.png



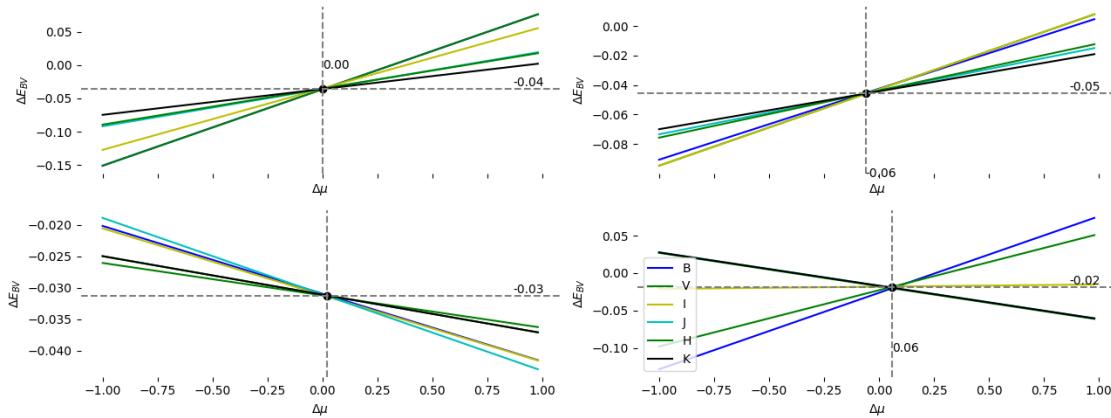
94\_53\_star\_JK\_g

./data/output/9\_plots/6\_rms/94\_53\_star\_JK\_g.png



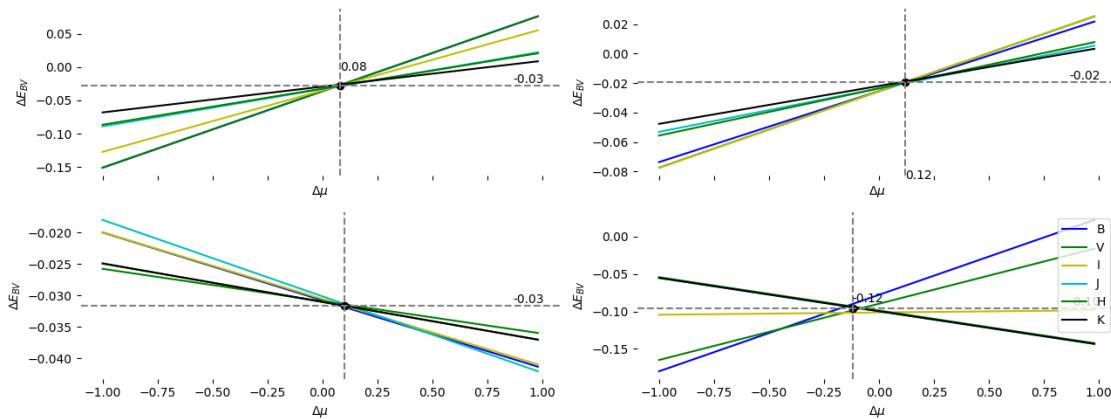
94\_54\_star\_JK\_g

./data/output/9\_plots/6\_rms/94\_54\_star\_JK\_g.png



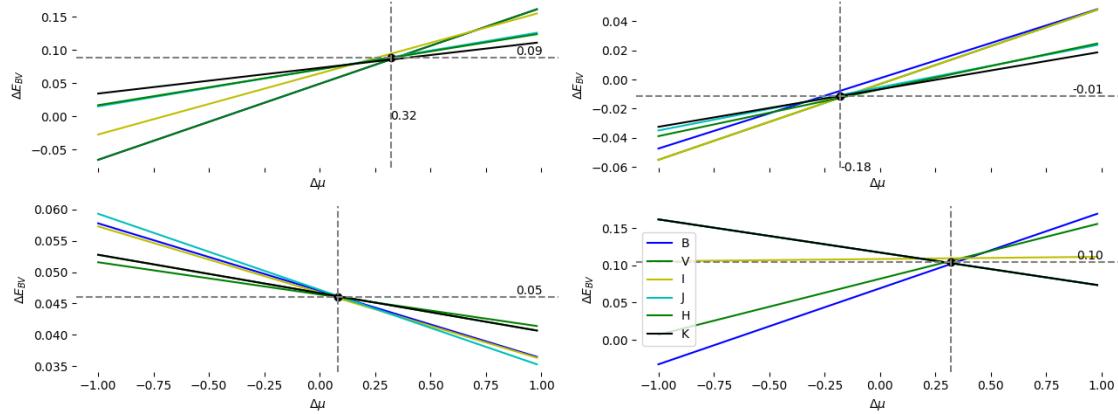
94\_55\_star\_JK\_g

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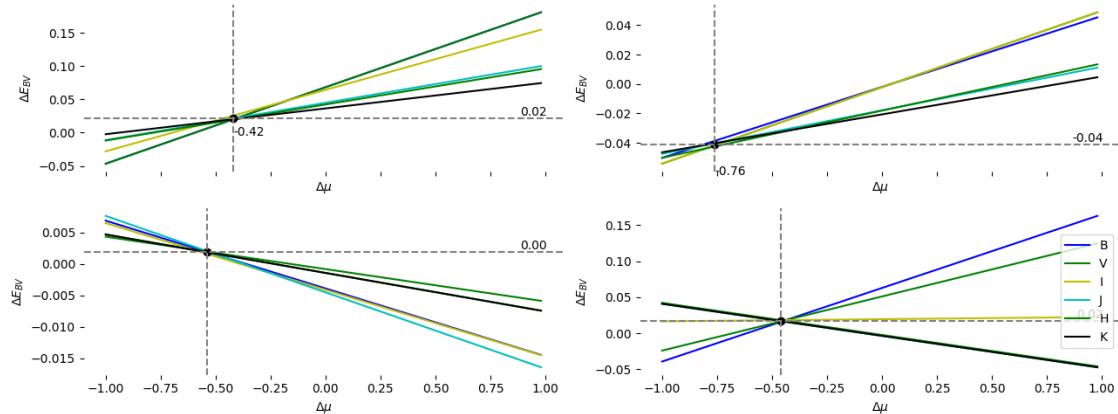
94\_56\_star\_JK\_g

./data/output/9\_plots/6\_rms/94\_56\_star\_JK\_g.png



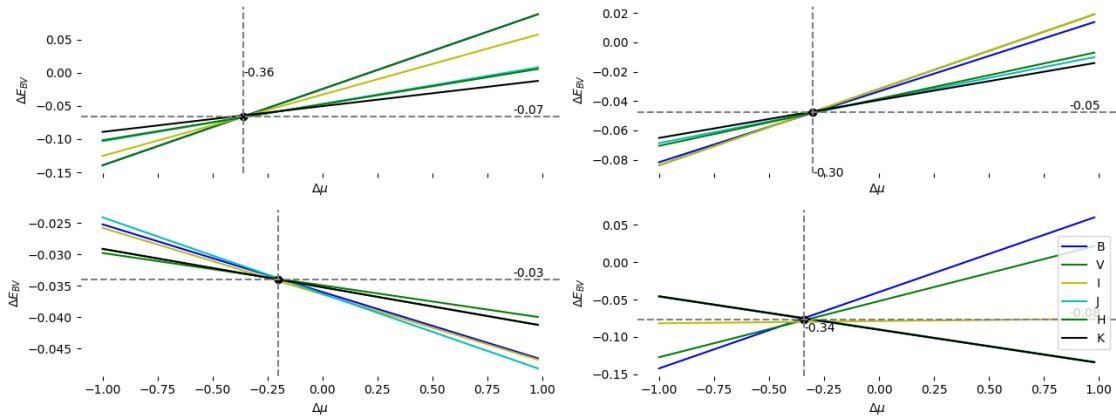
94\_57\_star\_JK\_g

./data/output/9\_plots/6\_rms/94\_57\_star\_JK\_g.png

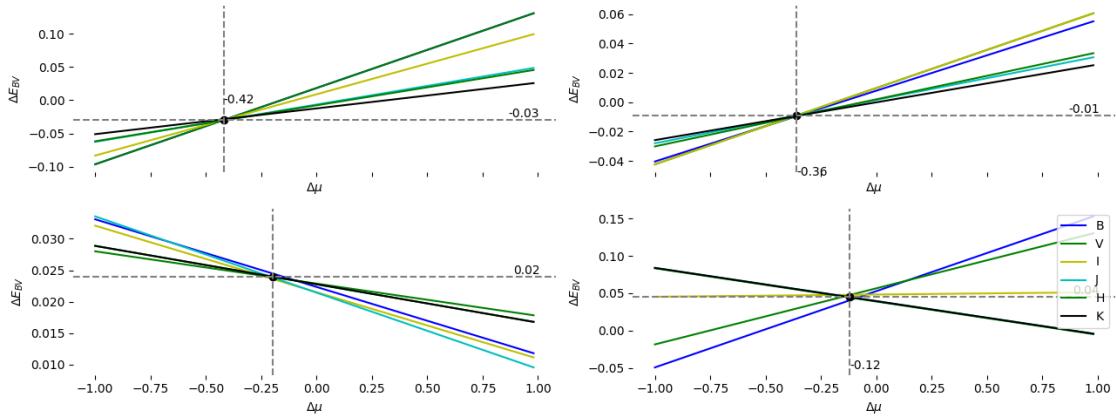


94\_58\_star\_JK\_g

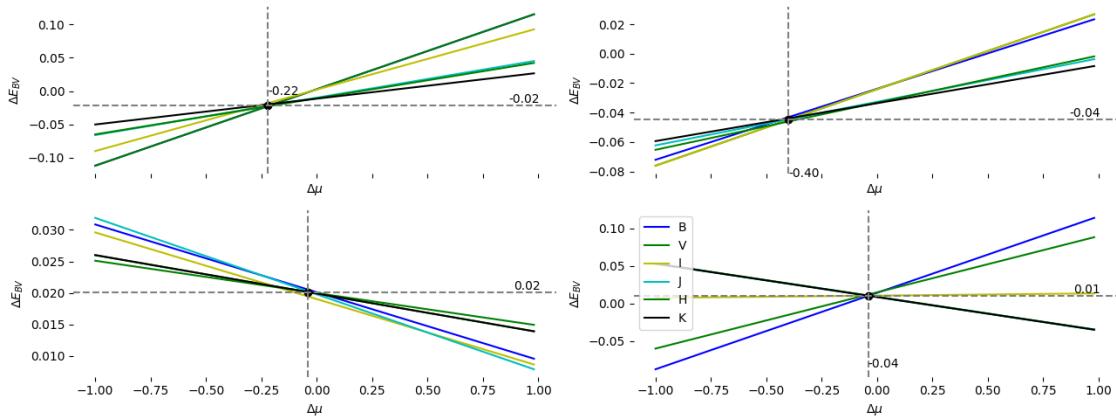
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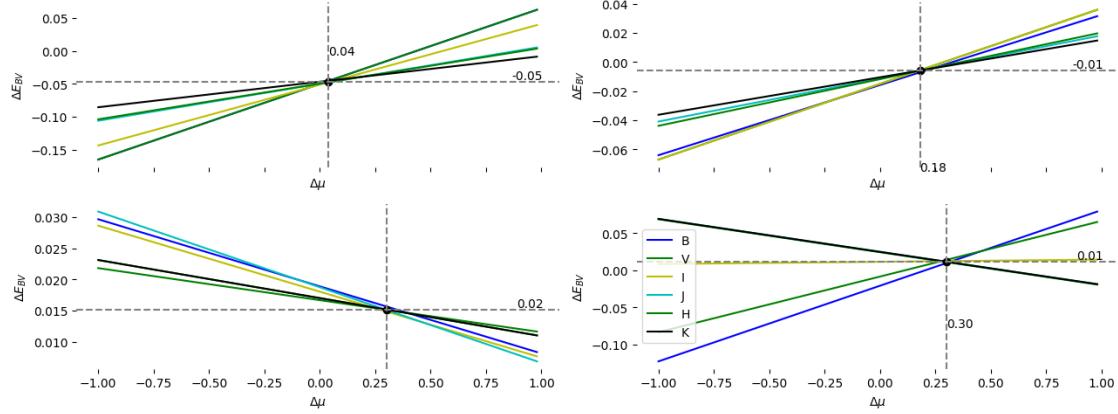
94\_59\_star\_JK\_g  
./data/output/9\_plots/6\_rms/94\_59\_star\_JK\_g.png



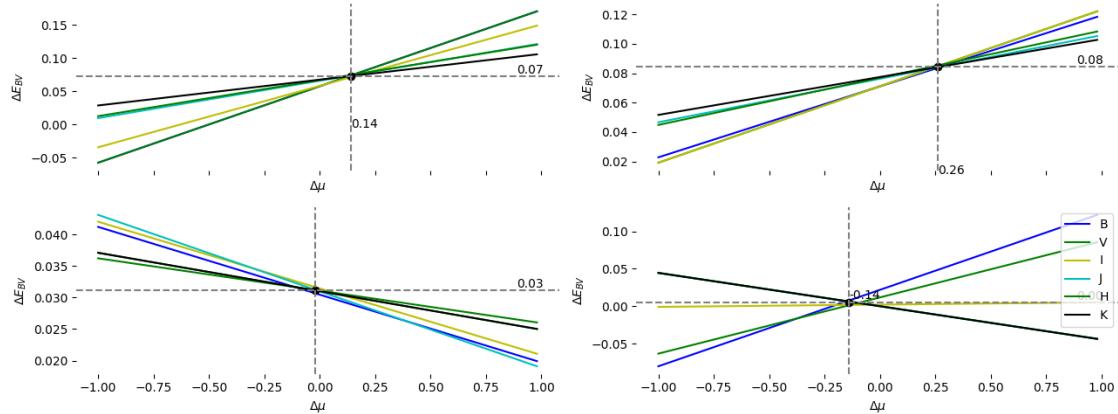
94\_60\_star\_JK\_g  
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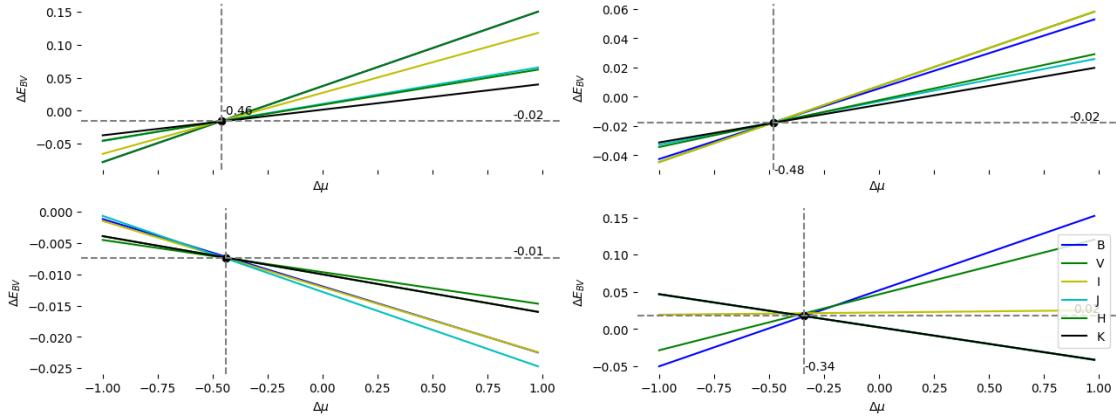
94\_61\_star\_JK\_g  
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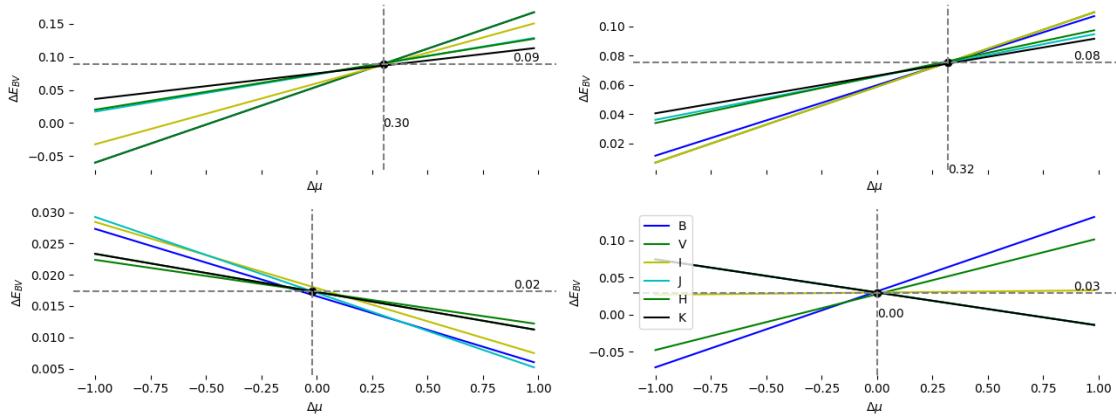
94\_62\_star\_JK\_g  
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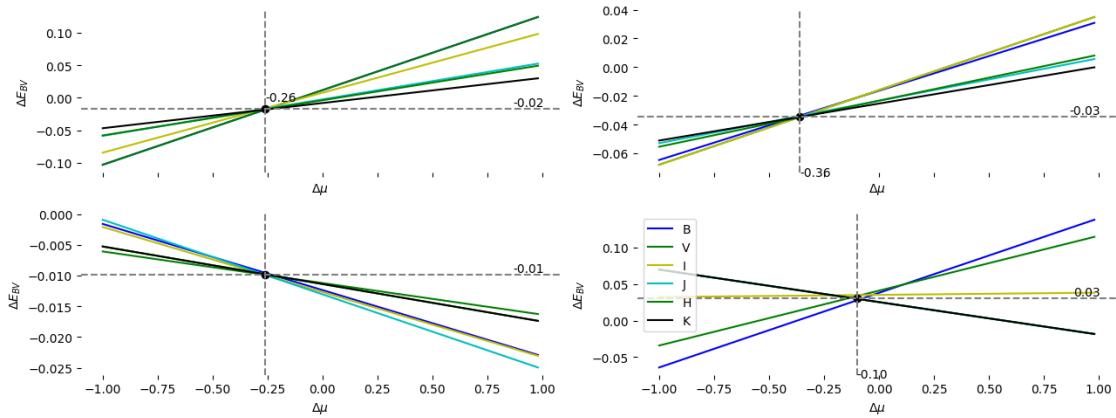
94\_63\_star\_JK\_g  
 ./data/output/9\_plots/6\_rms/94\_63\_star\_JK\_g.png



94\_64\_star\_JK\_g  
./data/output/9\_plots/6\_rms/94\_64\_star\_JK\_g.png

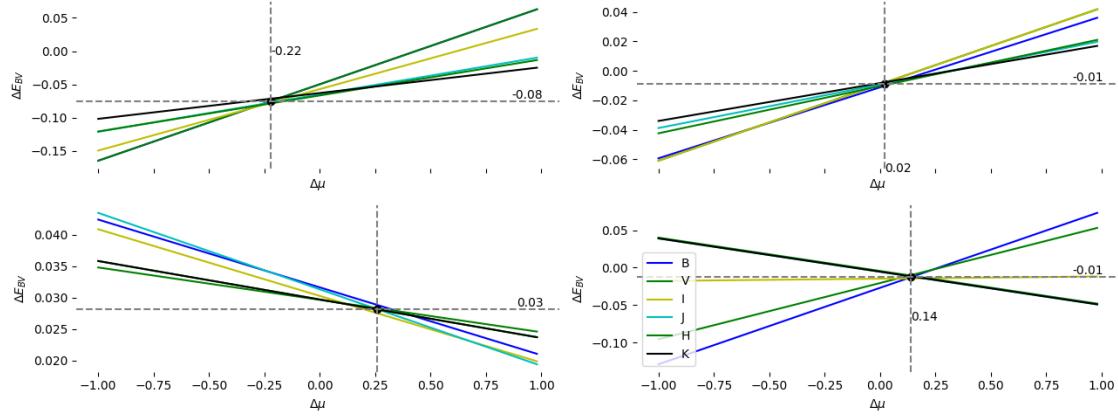


94\_65\_star\_JK\_g  
./data/output/9\_plots/6\_rms/94\_65\_star\_JK\_g.png



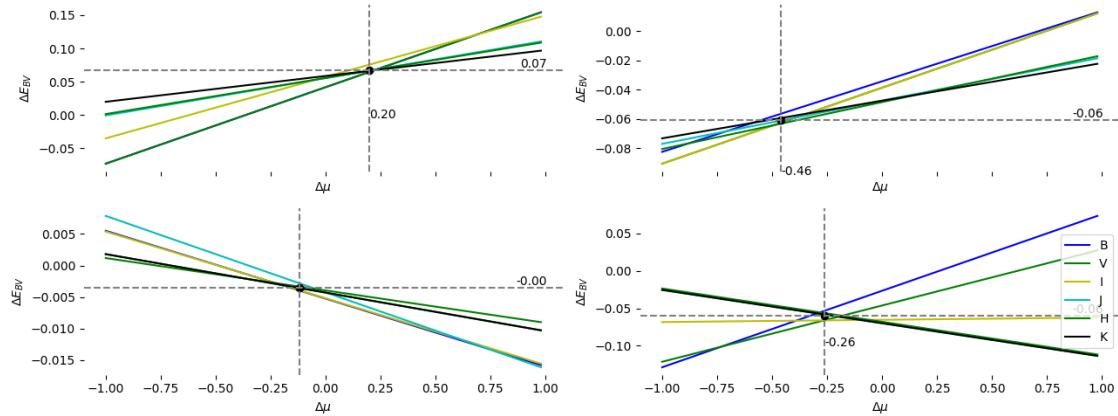
94\_66\_star\_JK\_g

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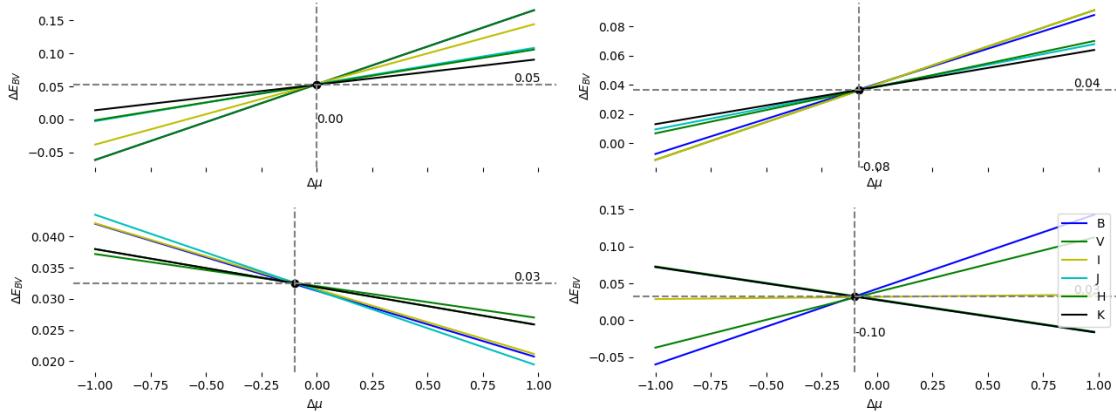
94\_67\_star\_JK\_g

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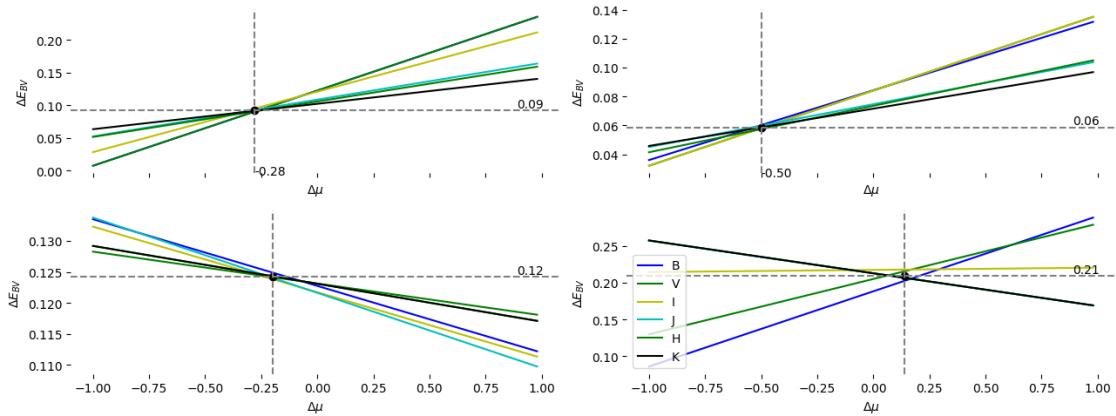


94\_68\_star\_JK\_g

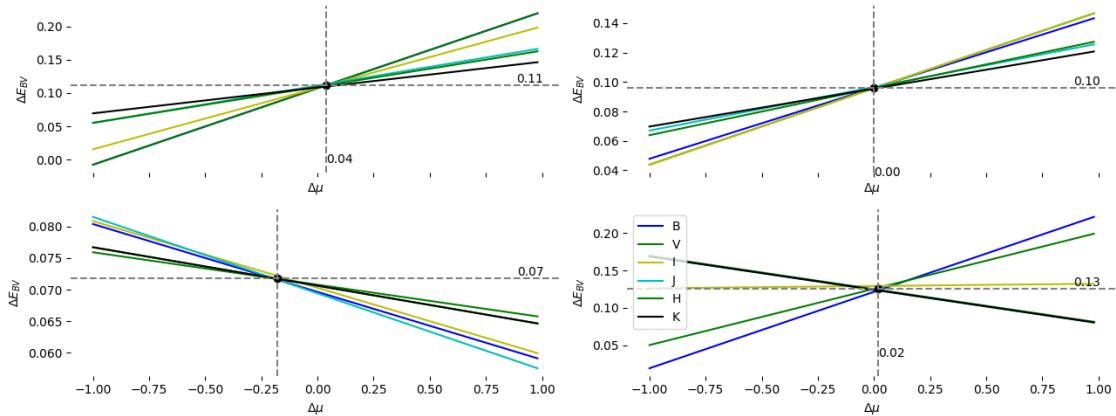
./data/output/9\_plots/6\_rms/94\_68\_star\_JK\_g.png



94\_69\_star\_JK\_g  
 $\text{./data/output/9_plots/6_rms/94\_69\_star\_JK\_g.png}$

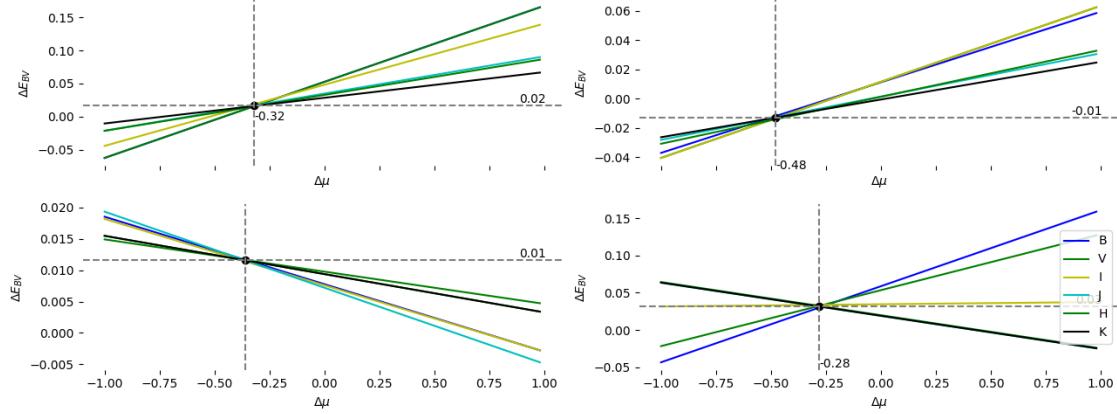


94\_70\_star\_JK\_g  
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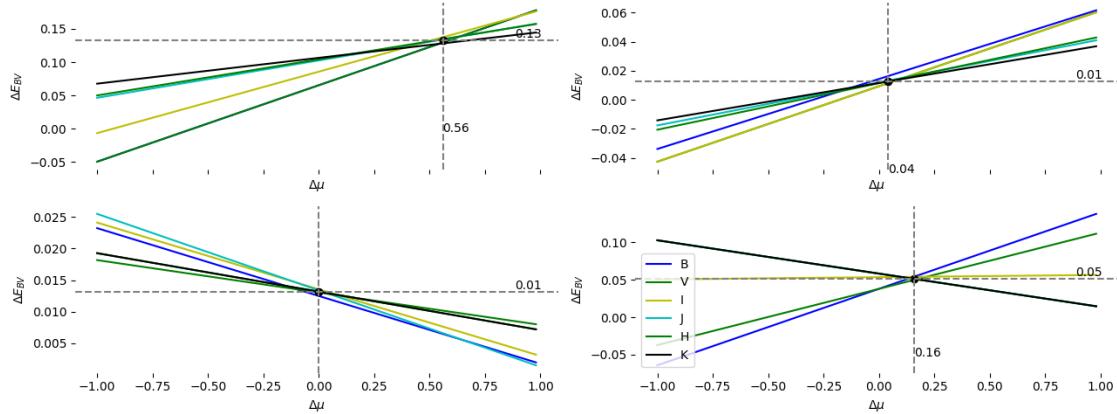
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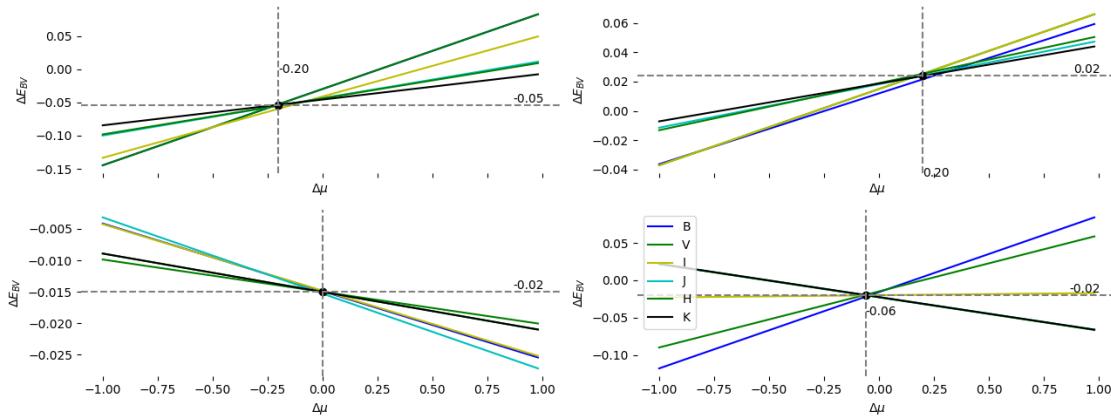
94\_72\_star\_JK\_g

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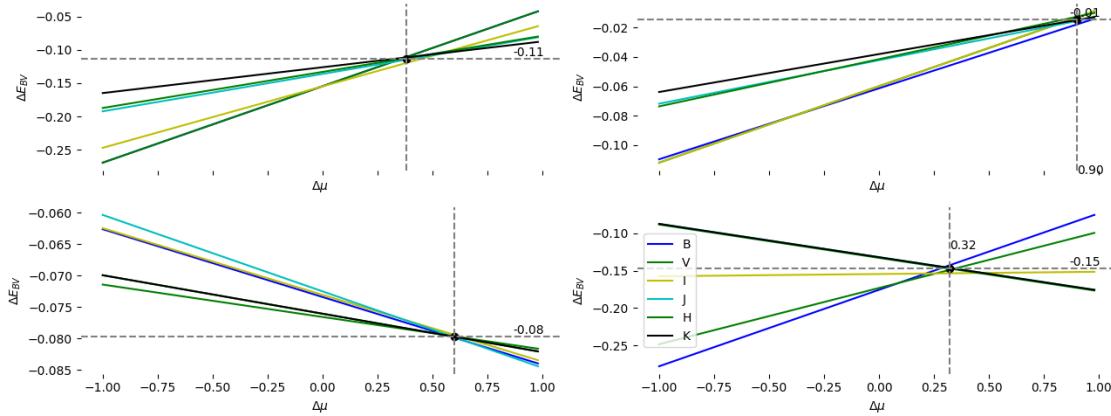


94\_73\_star\_JK\_g

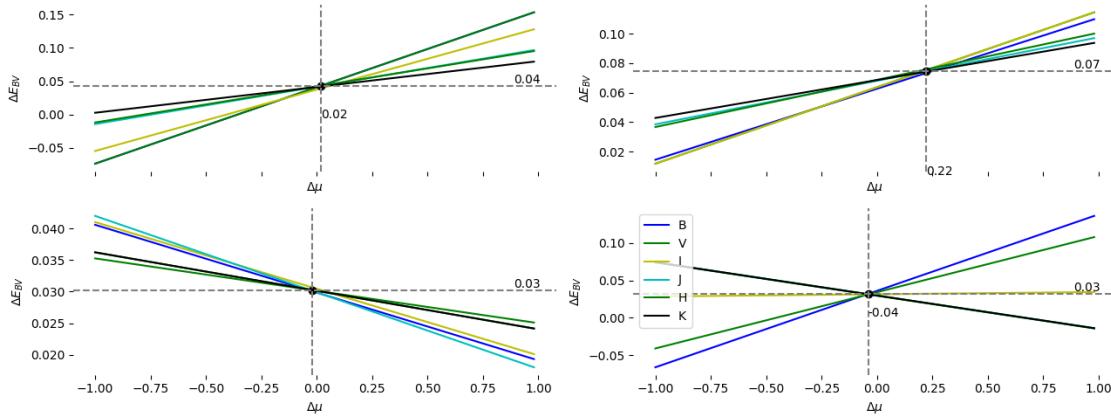
./data/output/9\_plots/6\_rms/94\_73\_star\_JK\_g.png



94\_74\_star\_JK\_g  
`./data/output/9_plots/6_rms/94_74_star_JK_g.png`

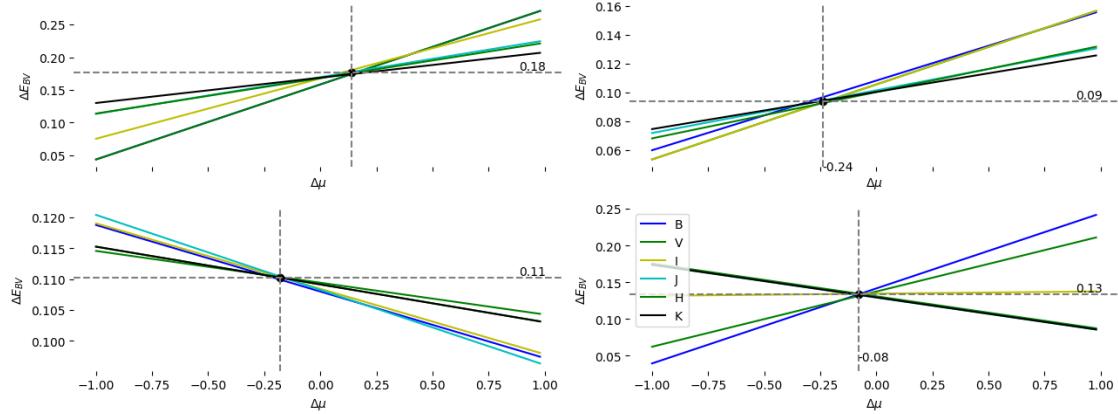


94\_75\_star\_JK\_g  
`./data/output/9_plots/6_rms/94_75_star_JK_g.png`



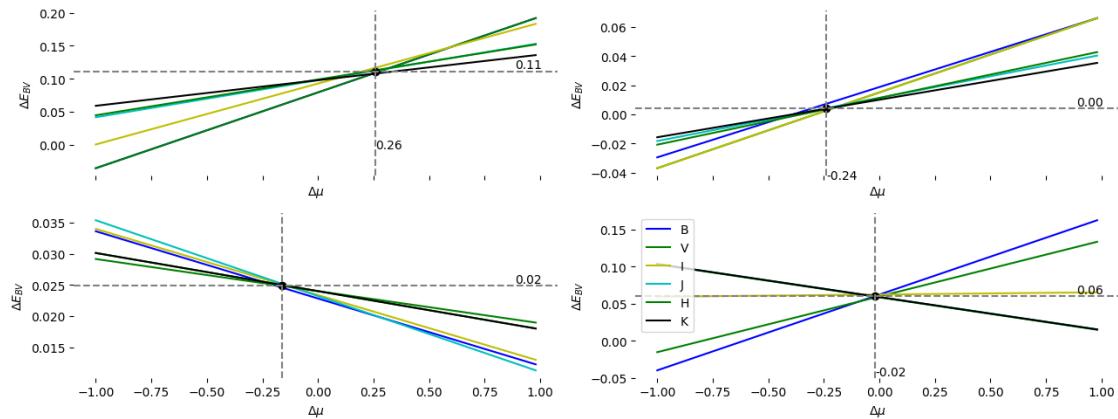
94\_76\_star\_JK\_g

./data/output/9\_plots/6\_rms/94\_76\_star\_JK\_g.png



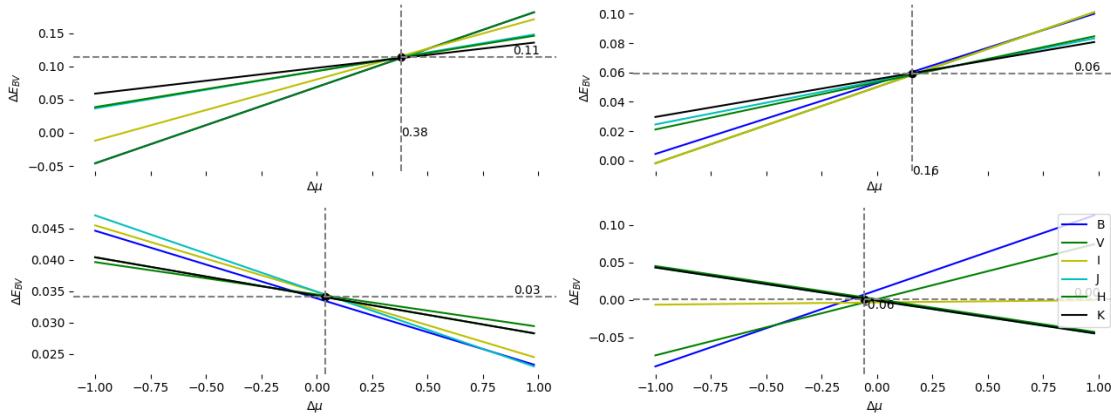
94\_77\_star\_JK\_g

./data/output/9\_plots/6\_rms/94\_77\_star\_JK\_g.png

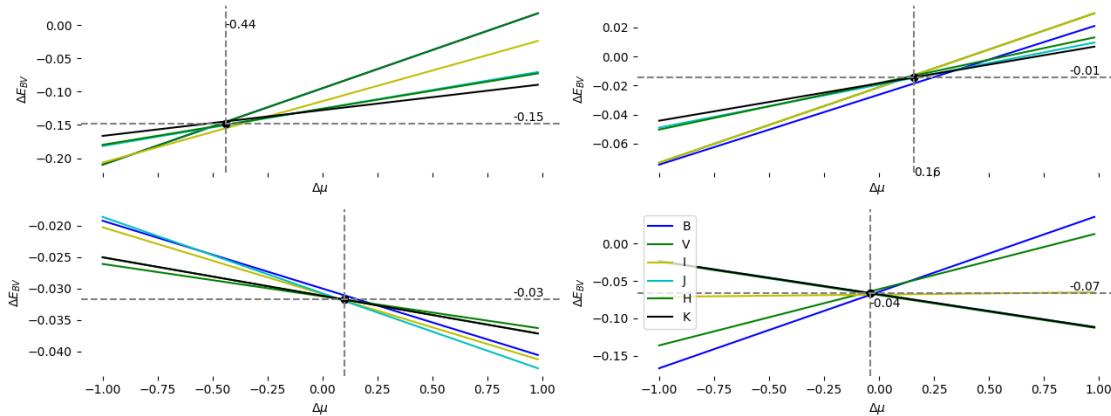


94\_78\_star\_JK\_g

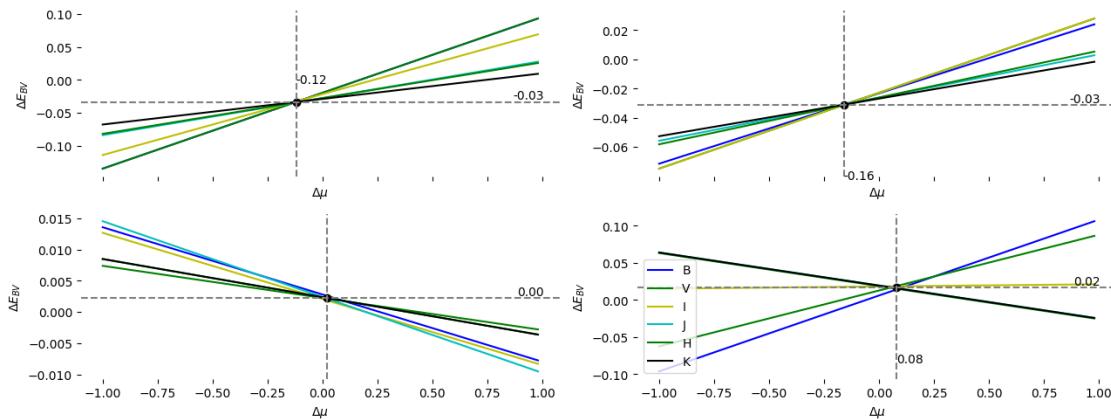
./data/output/9\_plots/6\_rms/94\_78\_star\_JK\_g.png



94\_79\_star\_JK\_g  
`./data/output/9_plots/6_rms/94_79_star_JK_g.png`

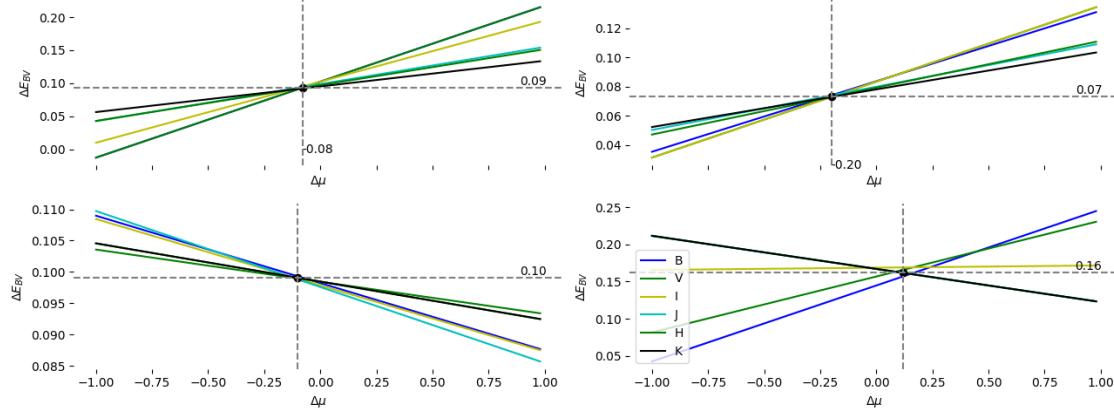


94\_80\_star\_JK\_g  
`./data/output/9_plots/6_rms/94_80_star_JK_g.png`



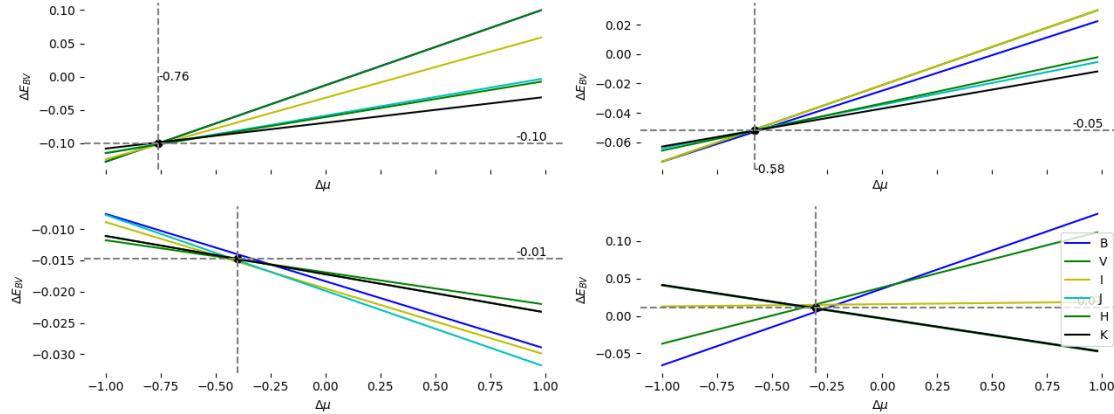
94\_81\_star\_JK\_g

./data/output/9\_plots/6\_rms/94\_81\_star\_JK\_g.png



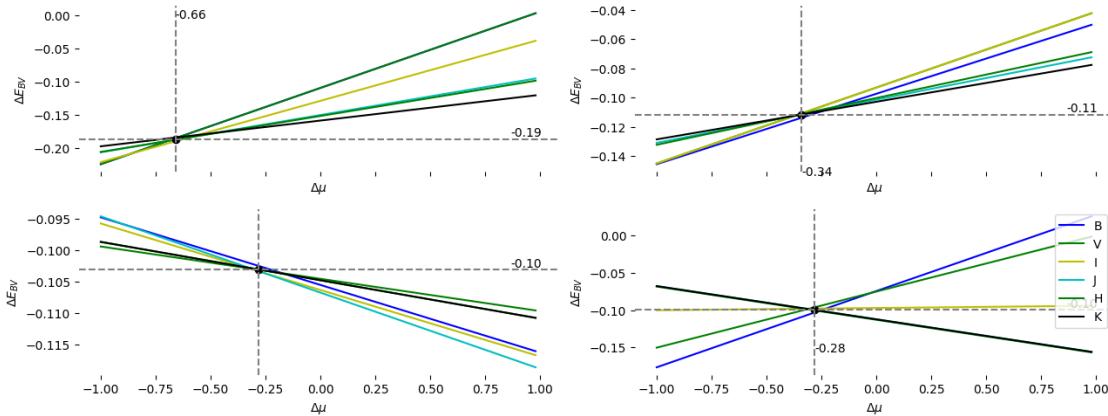
94\_82\_star\_JK\_g

./data/output/9\_plots/6\_rms/94\_82\_star\_JK\_g.png

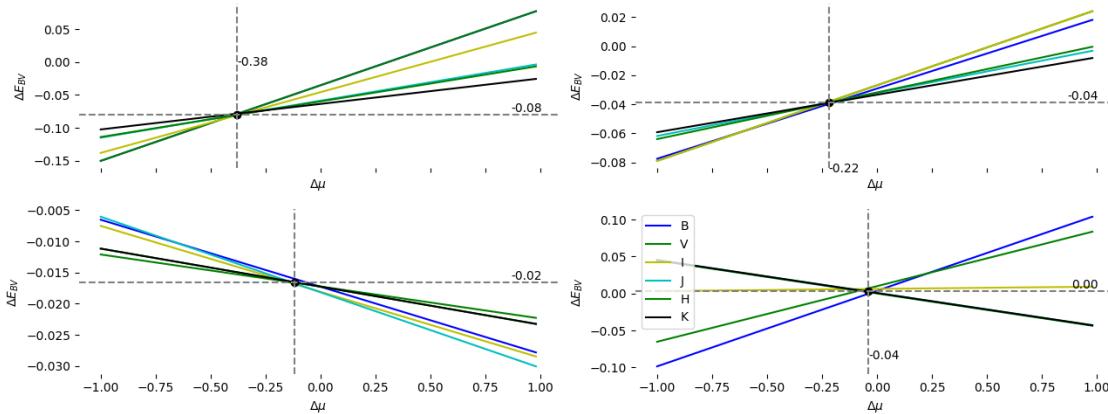


94\_83\_star\_JK\_g

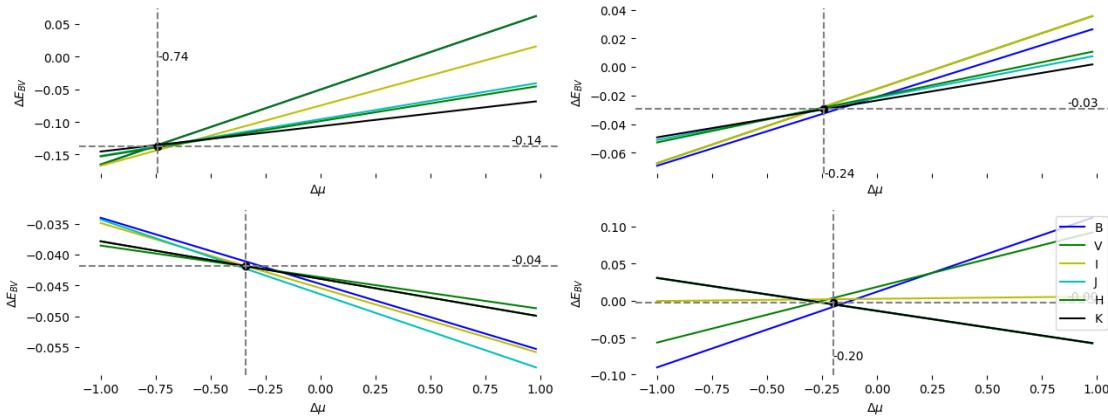
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94\_84\_star\_JK\_g  
`./data/output/9_plots/6_rms/94_84_star_JK_g.png`

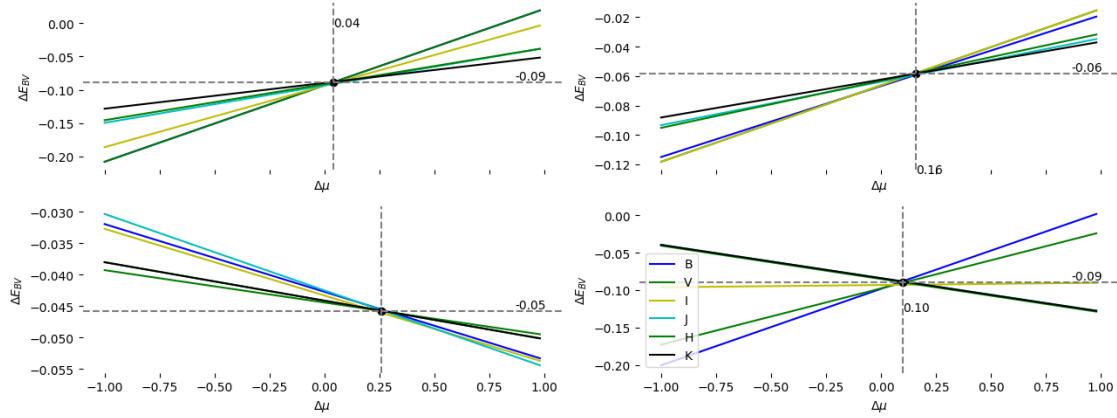


94\_85\_star\_JK\_g  
`./data/output/9_plots/6_rms/94_85_star_JK_g.png`



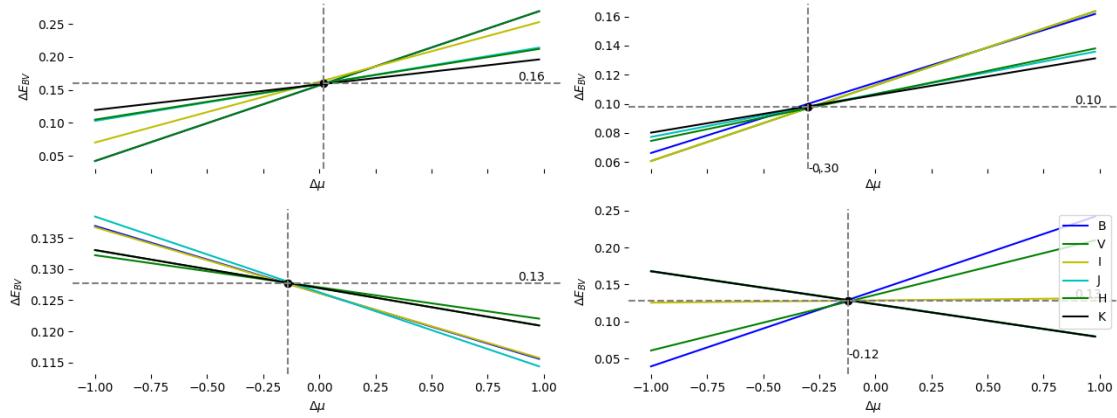
94\_86\_star\_JK\_g

./data/output/9\_plots/6\_rms/94\_86\_star\_JK\_g.png



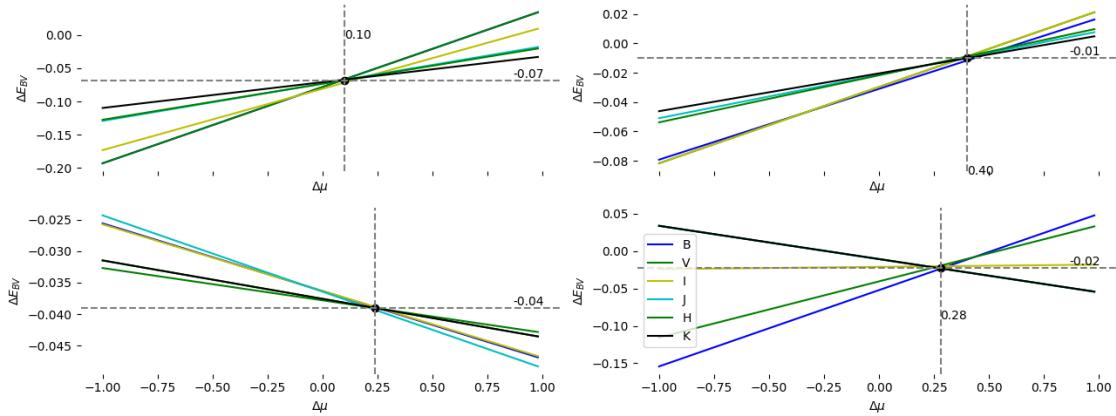
94\_87\_star\_JK\_g

./data/output/9\_plots/6\_rms/94\_87\_star\_JK\_g.png

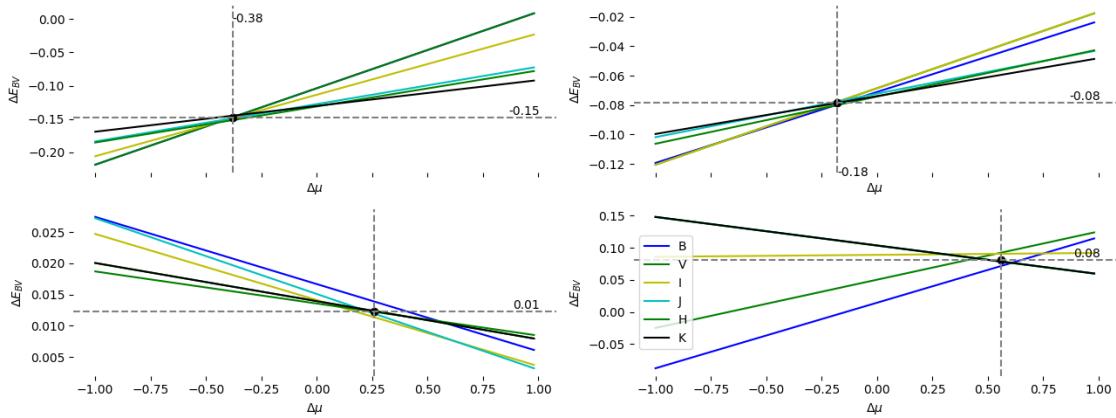


94\_88\_star\_JK\_g

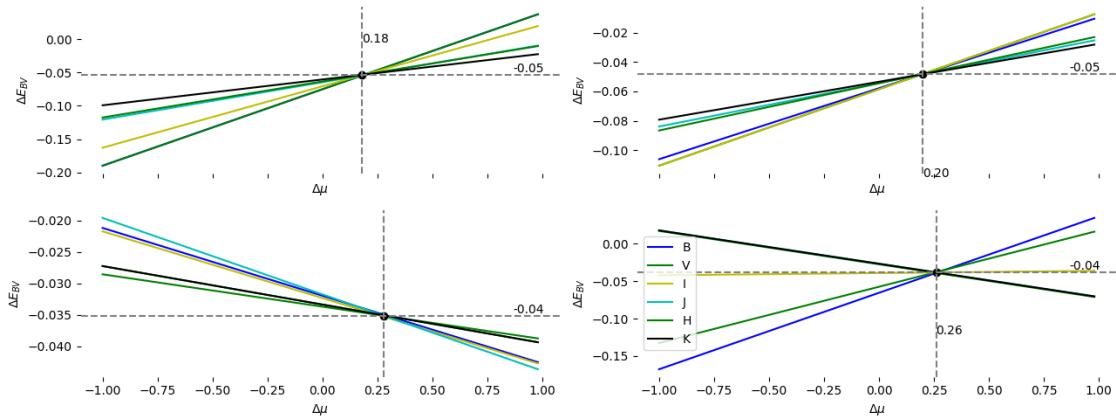
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94\_89\_star\_JK\_g  
`./data/output/9_plots/6_rms/94_89_star_JK_g.png`

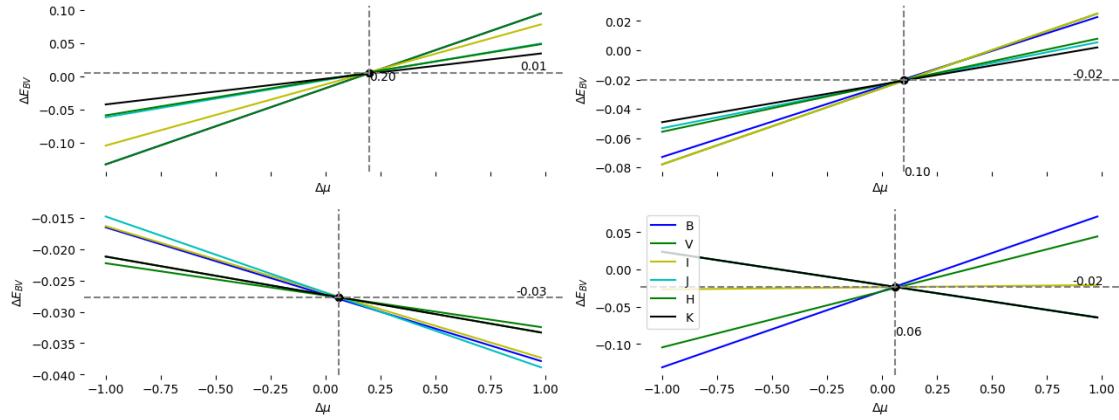


94\_90\_star\_JK\_g  
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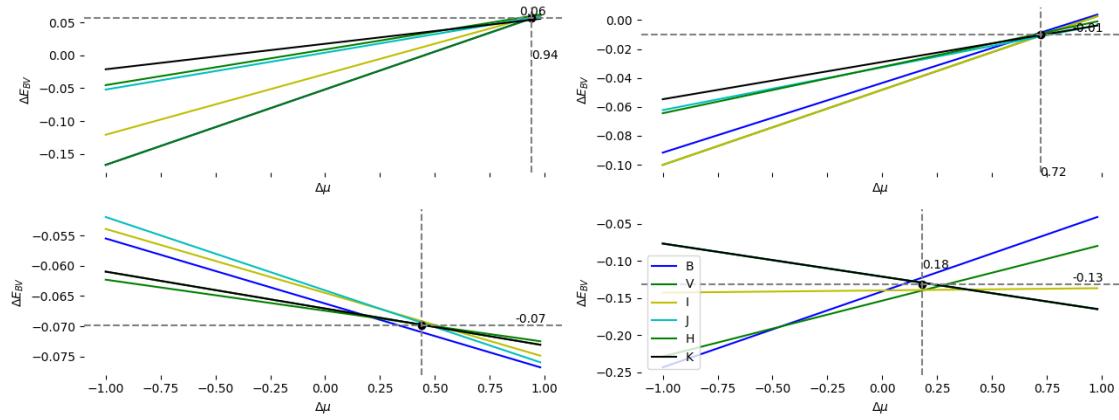
94\_91\_star\_JK\_g

./data/output/9\_plots/6\_rms/94\_91\_star\_JK\_g.png



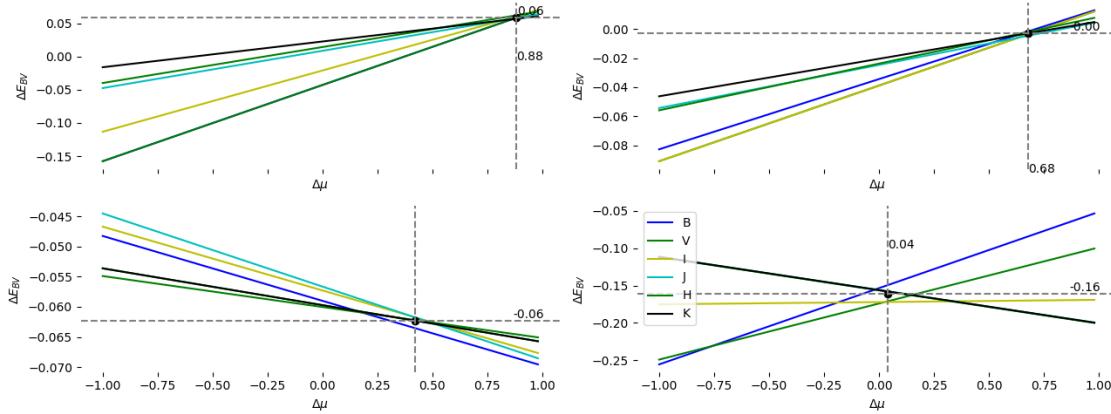
94\_92\_star\_JK\_g

./data/output/9\_plots/6\_rms/94\_92\_star\_JK\_g.png



94\_93\_star\_JK\_g

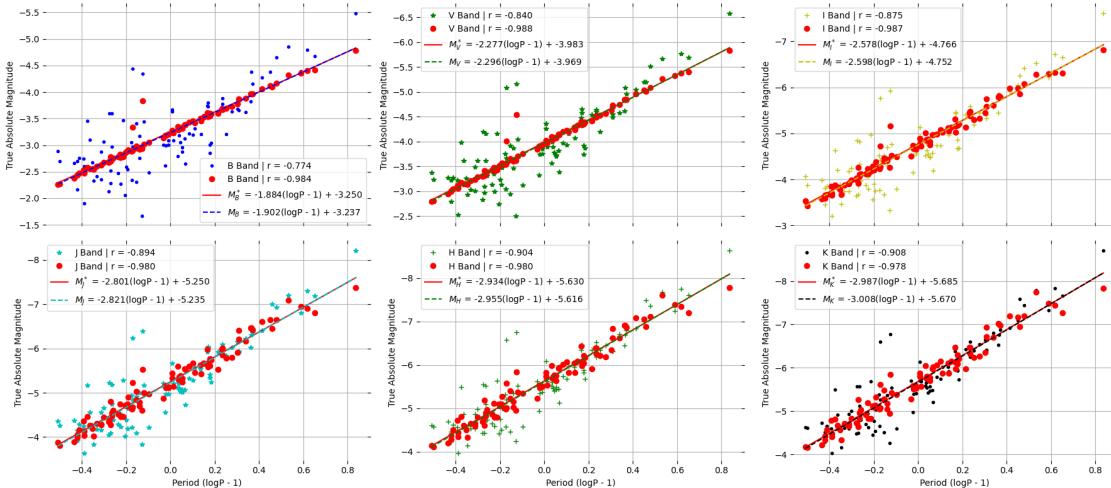
./data/output/9\_plots/6\_rms/94\_93\_star\_JK\_g.png



```
[39]: dis = '_i'
for col in wes_show:
    print(col)
resultPL6(new_M,result_reg,c,d,tbsolute, res, reg, pre, col,dis, s=1)
```

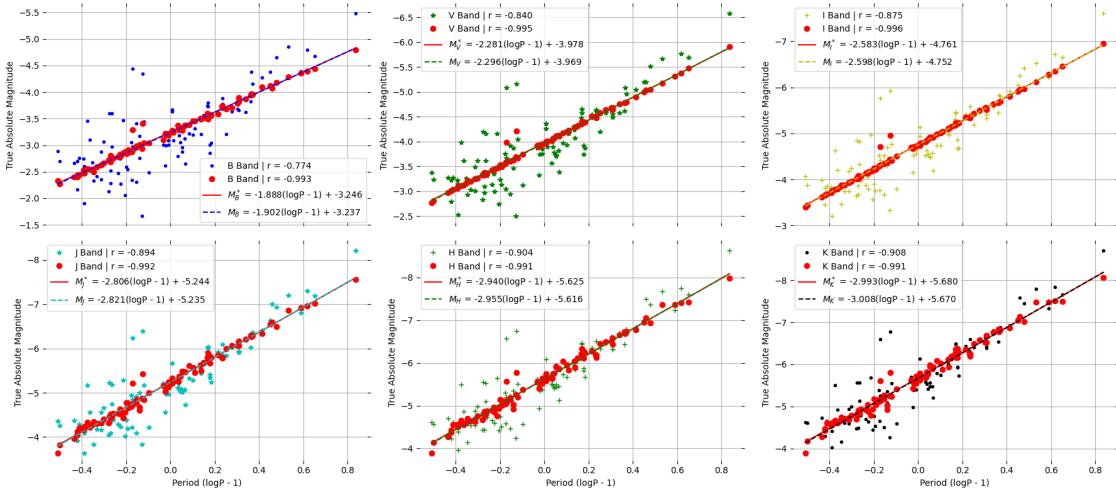
BV

./data/output/9\_plots/8\_result/94\_PL\_BV\_i.png



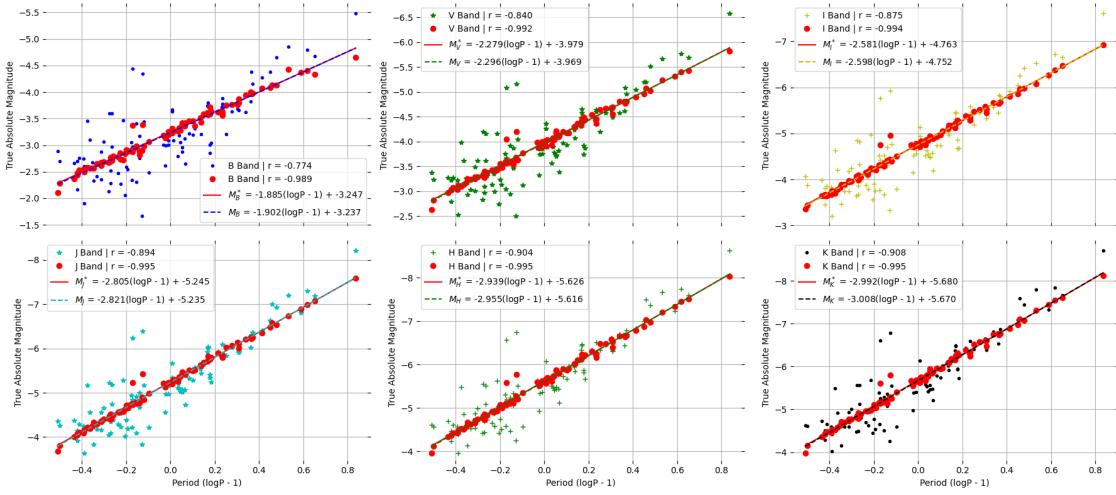
VI

./data/output/9\_plots/8\_result/94\_PL\_VI\_i.png



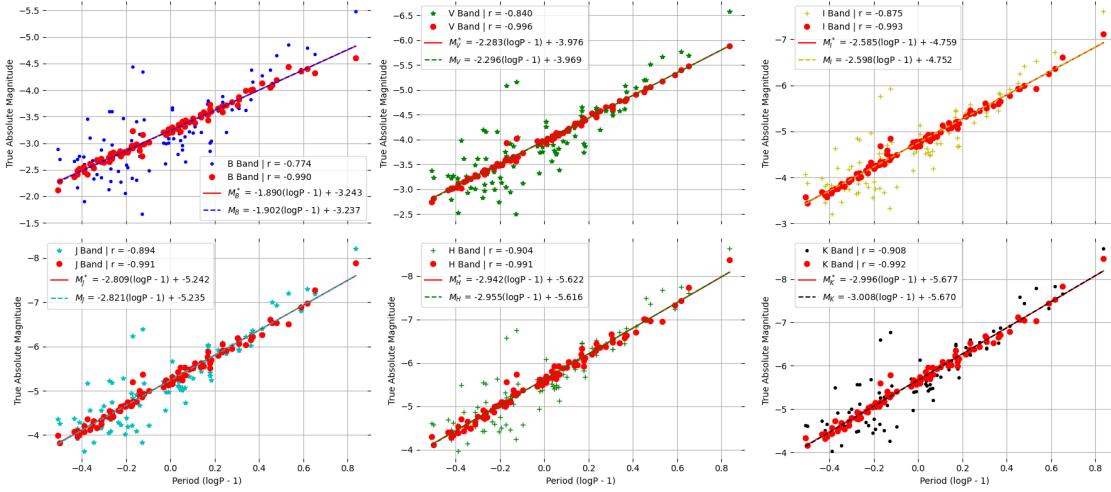
VK

`./data/output/9_plots/8_result/94_PL_VK_i.png`



JK

`./data/output/9_plots/8_result/94_PL_JK_i.png`

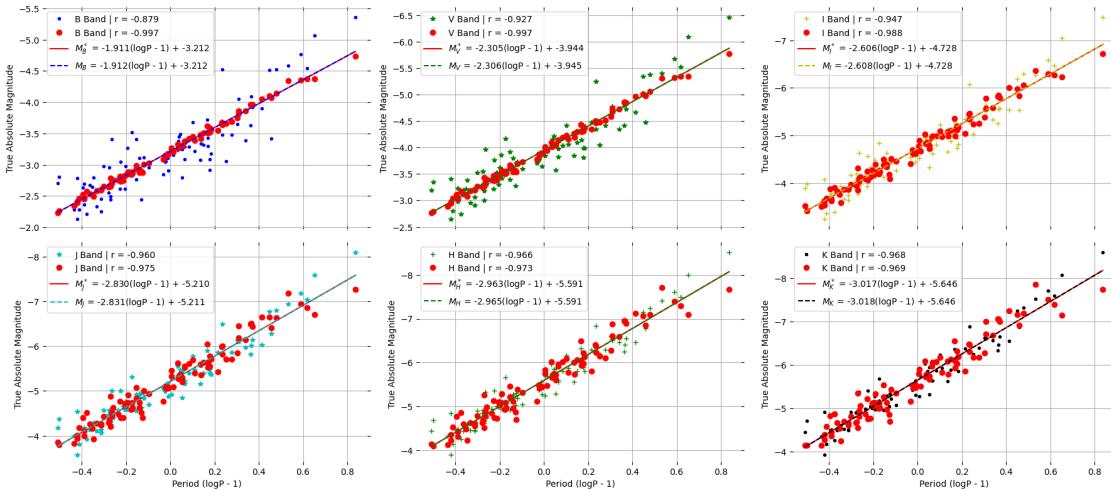


## 5 Applying correction to each Cepheid and rederiving the Leavitt Law

```
[2]: for col in wes_show:
    print(col)
    resultPL6(new_M,result_reg,c,d,tbsolute, res, reg, pre, col,dis, s=1)
```

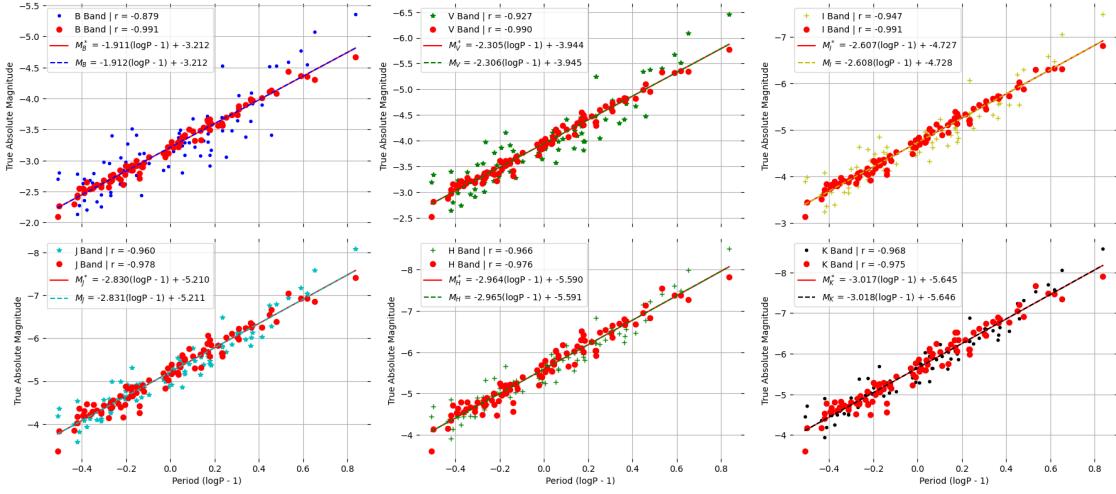
BV

`./data/output/9_plots/8_result/94_PL_BV_g.png`



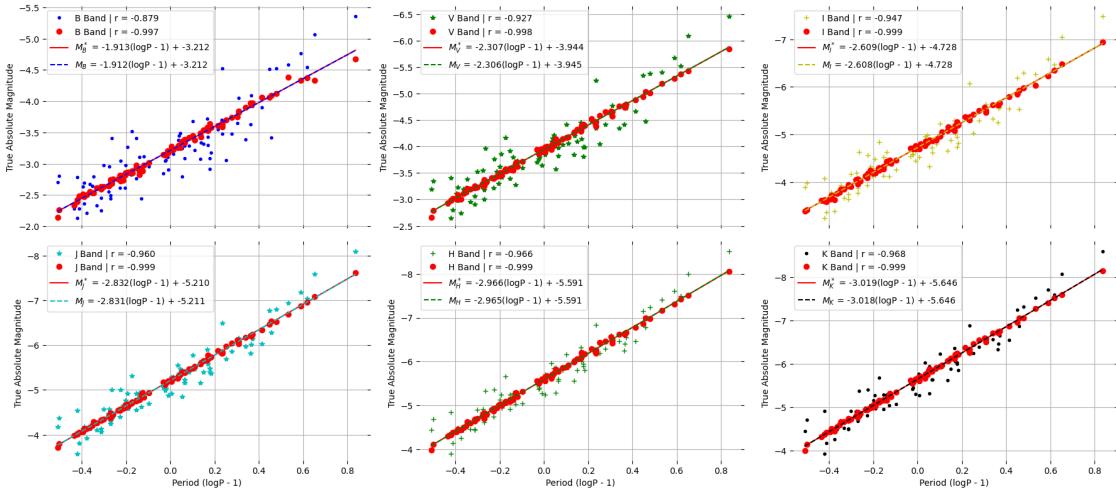
VI

`./data/output/9_plots/8_result/94_PL_VI_g.png`



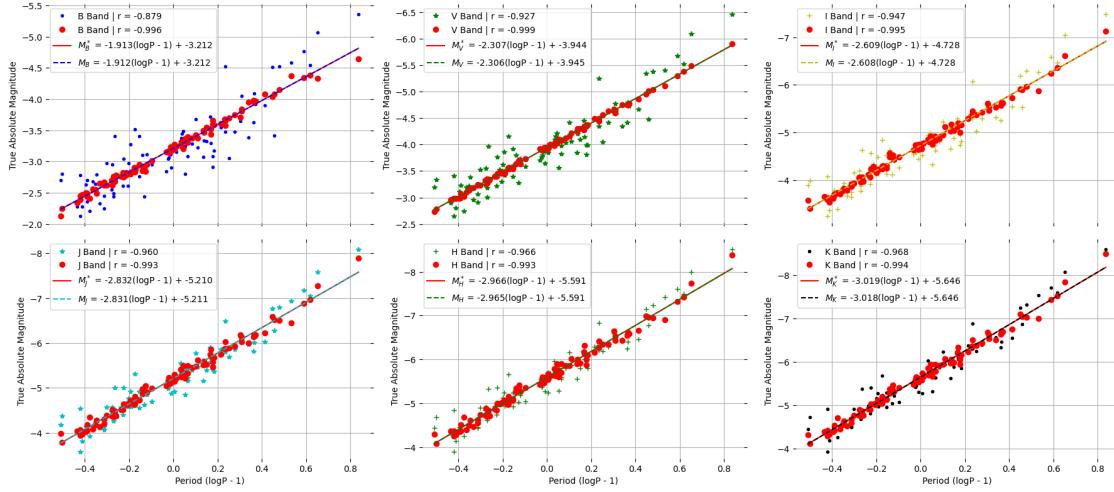
VK

./data/output/9\_plots/8\_result/94\_PL\_VK\_g.png



JK

./data/output/9\_plots/8\_result/94\_PL\_JK\_g.png



## 6 Comparing results

```
[2]: print_PL(reg, result_reg, '_g')
```

PL	:	Slope	Intercept
----	---	-------	-----------

Raw:

B_g	:	-1.9123864974122735	-3.212462099449801
Error	:	0.1082418612433724	0.0318365618546237
Calibrated:			
BV	:	-1.911094684133132	-3.2121642290434926
VI	:	-1.9113829876279136	-3.2117441722387934
VK	:	-1.9133585067196024	-3.212031626835007
JK	:	-1.91311504766036	-3.2120583294500533
Error BV	:	0.0145946461367618	0.004292640103764
Error VI	:	0.0273658910917582	0.0080489736081936
Error VK	:	0.0158393650071457	0.0046587421723481
Error JK	:	0.0188412492015033	0.0055416692648452

Raw:

V_g	:	-2.306002031121618	-3.9446221304426654
Error	:	0.0974796109079044	0.0286711224898137
Calibrated:			
BV	:	-2.3045581244499656	-3.9442891898591466
VI	:	-2.3049502426883577	-3.9438696639015016
VK	:	-2.3069660772350704	-3.944195184478146
JK	:	-2.3067364582125705	-3.944215103436487
Error BV	:	0.0183386066008522	0.0053938298609161

Error VI :	0.0343874443569271	0.0101141830592715
Error VK :	0.0136618728485588	0.0040182888117122
Error JK :	0.0093462534049277	0.0027489602563831

Raw:

I_g	: -2.6078562751525607	-4.727970991020887
Error	: 0.0924053231964117	0.027178651159966
Calibrated:		
BV	: -2.606220043932961	-4.727593703632638
VI	: -2.60674343758908	-4.727174848939657
VK	: -2.6088102516789182	-4.727548504562522
JK	: -2.608598133606104	-4.727559845477545
Error BV	: 0.0418652474986061	0.012313586686686
Error VI	: 0.0368771964445089	0.010846479653477
Error VK	: 0.0145140341591129	0.0042689301621281
Error JK	: 0.0269562507048005	0.007928488415425

Raw:

J_g	: -2.8314321440073624	-5.210698360160391
Error	: 0.0862415400055424	0.025365732733024
Calibrated:		
BV	: -2.829640875652171	-5.210285323817309
VI	: -2.8302700933695184	-5.2098670102458415
VK	: -2.8323780032135075	-5.210279468610047
JK	: -2.8321799930491185	-5.210283894571783
Error BV	: 0.067534662695324	0.0198635855068732
Error VI	: 0.0624837150734367	0.0183779790645826
Error VK	: 0.0108073147932253	0.00317869391698
Error JK	: 0.0351488027400385	0.0103381170620596

Raw:

H_g	: -2.9652708725308856	-5.591102681377289
Error	: 0.0821319327719988	0.0241569973751319
Calibrated:		
BV	: -2.963425144928697	-5.590677087648172
VI	: -2.964091535021983	-5.590258964154201
VK	: -2.9662138803998688	-5.59068505259527
JK	: -2.966020825861539	-5.590687049570251
Error BV	: 0.0739910325901547	0.0217625607938091
Error VI	: 0.068803438102218	0.02023676318746
Error VK	: 0.0145067183241297	0.0042667783972722
Error JK	: 0.036533529599773	0.0107453988827462

Raw:

```

K_g      : -3.0183959501451385   -5.646009730253158
Error    : 0.0817103150048123   0.0240329893437672
Calibrated:
BV       : -3.0165198038644494   -5.6455771224885964
VI       : -3.017206956906459   -5.645159105164037
VK       : -3.0193373653753475   -5.645592806801192
JK       : -3.019147078844365   -5.64559344704483
Error BV : 0.0799948774150932   0.023528437460554
Error VI : 0.0722737050299169   0.0212574530243369
Error VK : 0.0134269743555647   0.0039491994564862
Error JK : 0.03449515907366   0.0101458645751151

```

[6]: `print_PL(reg, b, '_i')`

PL	Slope	Intercept
B_i	-1.902365270362809	-3.2368862783166827
BV	-1.8835821441673972	-3.2500380135887226
VI	-1.887741972928828	-3.2458358348232927
VK	-1.8854022064030165	-3.2471088409085067
JK	-1.8895861885336316	-3.243351471200246
Error	0.1623501304589864	0.0477511187547159
Error BV	0.0353928241506	0.0104098896890447
Error VI	0.0233486308965719	0.0068673997584738
Error VK	0.0300173254911575	0.0088288248994621
Error JK	0.027369441309753	0.0080500178135822
V_i	-2.295980804072152	-3.969046309309547
BV	-2.276613325921537	-3.9826072012970672
VI	-2.281259868288528	-3.978055621143661
VK	-2.2790910137613394	-3.9792247145212687
JK	-2.283204067642377	-3.975510315608684
Error	0.1547596707823444	0.0455185801026217
Error BV	0.0364983150273655	0.0107350414212266
Error VI	0.0249108202205645	0.0073268776025409
Error VK	0.0311640772744531	0.0091661124669652
Error JK	0.0208648641885052	0.0061368636098387
I_i	-2.5978350481030965	-4.7523951698877696
BV	-2.5777286474800976	-4.766473447141315
VI	-2.5829906470515334	-4.7614800432973095
VK	-2.58103791350325	-4.762517737380134
JK	-2.585061277468696	-4.7588576757317576
Error	0.1499811542806435	0.0441131022733216
Error BV	0.0430601088196238	0.0126650244383775
Error VI	0.0251018781086	0.0073830723704467
Error VK	0.0285911193467374	0.0084093430131318
Error JK	0.0313603520568858	0.0092238416502927

J_i	:	-2.821410916957899	-5.235122539027274
BV	:	-2.800708854341852	-5.2496178921585335
VI	:	-2.8064669877821813	-5.244268324319044
VK	:	-2.804688474206688	-5.245200094480565
JK	:	-2.8086395371177284	-5.241583835320684
Error	:	0.147523386537531	0.043390213052099
Error BV	:	0.0588935988268986	0.0173220386304911
Error VI	:	0.0374406987653261	0.0110122193801026
Error VK	:	0.0300583943248473	0.0088409042414934
Error JK	:	0.0397814909159099	0.0117007032368548
H_i	:	-2.95524964548142	-5.615526860244172
BV	:	-2.934338347165286	-5.630168717876781
VI	:	-2.940270755477282	-5.62469404179837
VK	:	-2.9385534394238784	-5.625588604506524
JK	:	-2.942479105445552	-5.621987731663802
Error	:	0.1452862125369353	0.0427322058113571
Error BV	:	0.0624686148825788	0.0183735377314907
Error VI	:	0.0413157049359825	0.0121519528641912
Error VK	:	0.0317942211182517	0.009351453085003
Error JK	:	0.0410940417947339	0.0120867563475554
K_i	:	-3.008374723095673	-5.67043390912004
BV	:	-2.9873465543885005	-5.685157598095744
VI	:	-2.993376305421608	-5.679613041739739
VK	:	-2.991693171767928	-5.680486821906369
JK	:	-2.995604652139687	-5.676894543222784
Error	:	0.1446712294203597	0.0425513243316273
Error BV	:	0.0665760379327512	0.019581630667974
Error VI	:	0.0432613644981581	0.0127242186242927
Error VK	:	0.0308012145281709	0.0090593857150963
Error JK	:	0.0395781355719962	0.011640891488326

## 7 LMC and SMC

```
[4]: LMC = pd.read_csv('data/input/36_LMC.csv')
SMC = pd.read_csv('data/input/32_SMC.csv')

xl=LMC['logP']-1
xs=SMC['logP']-1
xm = a['logP']-1
x_str = 'logP - 1'
cl, cs = [], []
for i, m in enumerate(mag):
    y_str = m
    yl=LMC[f'{m}_mag']- R[i]*LMC['EBV'] #- LMC['IRSB']
```

```

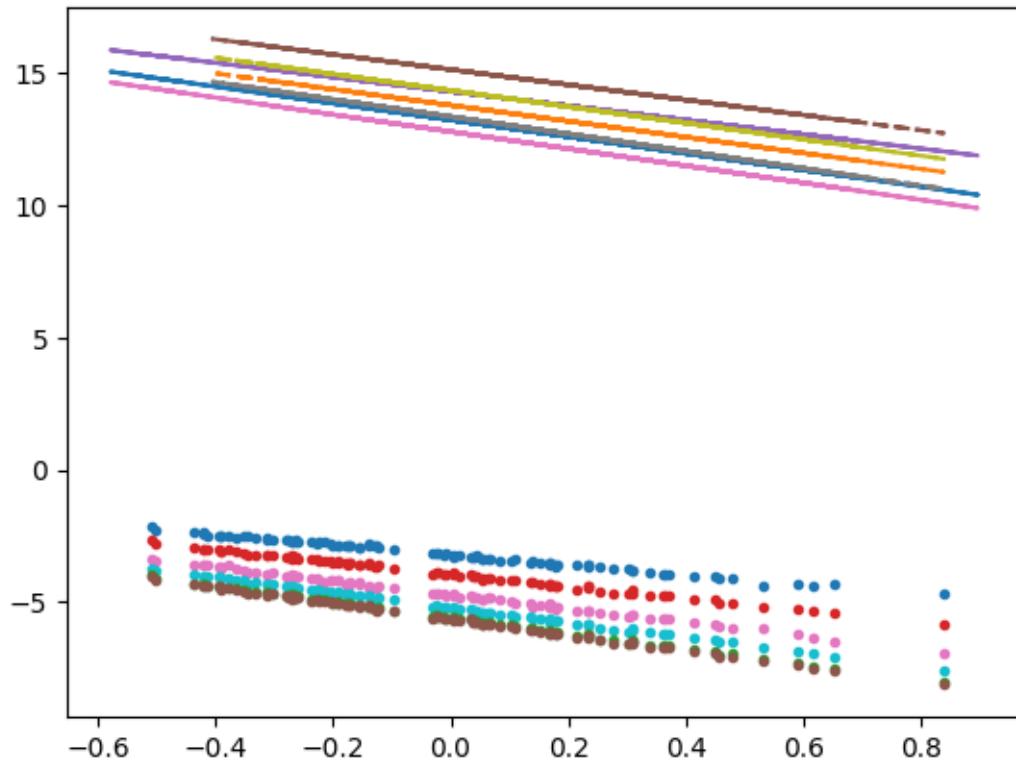
ys=SMC[f'{m}_mag']- R[i]*SMC['EBV'] #- SMC['IRSB']
rl = regression(xl, yl, x_str, y_str+'l', p = 1)
cl.append(rl[1])
rs = regression(xs, ys, x_str, y_str+'s', p = 1)
cs.append(rs[1])
plt.plot(xm, a[f'{m}_gVK'], '.')
plt.plot(xl, rl[2], '-')
plt.plot(xs, rs[2], '--')
# plt.show()

```

```

B1 = nan logP - 1 ( nan) + nan ( nan)
Bs = nan logP - 1 ( nan) + nan ( nan)
V1 = -2.706949 logP - 1 ( 0.084474) + 14.320653 ( 0.037490)
Vs = -2.867396 logP - 1 ( 0.138611) + 15.147970 ( 0.054195)
I1 = nan logP - 1 ( nan) + nan ( nan)
Is = -3.090800 logP - 1 ( 0.101662) + 14.360588 ( 0.039748)
J1 = -3.158379 logP - 1 ( 0.051325) + 13.239033 ( 0.022778)
Js = -3.015492 logP - 1 ( 0.087734) + 13.798822 ( 0.034303)
H1 = nan logP - 1 ( nan) + nan ( nan)
Hs = nan logP - 1 ( nan) + nan ( nan)
K1 = -3.226290 logP - 1 ( 0.037697) + 12.798097 ( 0.016730)
Ks = -3.259169 logP - 1 ( 0.070413) + 13.370874 ( 0.027530)

```



## 8 Distance to LMC

```
[30]: mod_LMC = pd. DataFrame()
for col in wes_show:
    rcg = result_reg[[f'{m}{col}'] for m in mag].loc[1].values
    mod_LMC[col+'_g'] = cl - rcg
    rci = result_reg[[f'{m}{col}'] for m in mag].loc[5].values
    mod_LMC[col+'_i'] = cl - rci
    mod_LMC.index = mag
mod_LMC
```

```
[30]:      BV_g        BV_i        VI_g        VI_i        VK_g        VK_i  \
B        NaN        NaN        NaN        NaN        NaN        NaN
V  18.264942  18.303260  18.264523  18.298709  18.264848  18.299878
I        NaN        NaN        NaN        NaN        NaN        NaN
J  18.449318  18.488651  18.448900  18.483301  18.449313  18.484233
H        NaN        NaN        NaN        NaN        NaN        NaN
K  18.443674  18.483255  18.443256  18.477710  18.443690  18.478584

          JK_g        JK_i
B        NaN        NaN
V  18.264868  18.296164
I        NaN        NaN
J  18.449317  18.480617
H        NaN        NaN
K  18.443691  18.474992
```

## 9 Distance to SMC

```
[32]: mod_SMC = pd. DataFrame()
for col in wes_show:
    rcg = result_reg[[f'{m}{col}'] for m in mag].loc[1].values
    mod_SMC[col+'_g'] = cs - rcg
    rci = result_reg[[f'{m}{col}'] for m in mag].loc[5].values
    mod_SMC[col+'_i'] = cs - rci
    mod_SMC.index = mag
mod_SMC
```

```
[32]:      BV_g        BV_i        VI_g        VI_i        VK_g        VK_i  \
B        NaN        NaN        NaN        NaN        NaN        NaN
V  19.092259  19.130577  19.091839  19.126025  19.092165  19.127194
I  19.088182  19.127062  19.087763  19.122068  19.088137  19.123106
J  19.009107  19.048440  19.008689  19.043090  19.009102  19.044022
H        NaN        NaN        NaN        NaN        NaN        NaN
K  19.016451  19.056031  19.016033  19.050487  19.016467  19.051361
```

	JK_g	JK_i
B	NaN	NaN
V	19.092185	19.123480
I	19.088148	19.119446
J	19.009106	19.040406
H	NaN	NaN
K	19.016467	19.047768

```
[ ]: !pdflatex pipeline.tex
```