In [ ]:
```
#File Name: HexPlot.py
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#Last Updated: 20 December 2016

#Edited by Lauren Laufman

import math
import numpy
import seaborn as sea
import matplotlib.pyplot as plt
from scipy import *
from matplotlib import ticker
from matplotlib.colors import LogNorm
from mpl_toolkits.axes_grid1 import make_axes_locatable
from pylab import *
```

In [2]:
```
#Set up plotting environment
fig_width  = 4.0 # column width in inches
fig_height = 3.8 # Good enough for the greeks
fig_size   =  [fig_width,fig_height]
```

In [3]:
```
#This sets up the display environmentt
params = {'backend': 'pdf',         # use eps output
          'axes.labelsize': 10,
          'font.family':'sans-serif',    # font family
#          'text.fontsize': 8,       # 8pt font
          'font.size': 8,
          'font.sans-serif': 'Arial', # font type
          'legend.fontsize': 6,
#          'legend.markersize': 2,
          'xtick.labelsize': 8,
          'ytick.labelsize': 8,
          'text.usetex': True,   # will need TeX installtion, but will g
et LaTeX labels
          'figure.figsize': fig_size, # set above
          'figure.dpi': 300,          # resolution of figure in DPI (300
is ApJ for images, 600+ for line plots)
          'axes.linewidth': 0.75,
          'lines.markersize': 3,
          'lines.markeredgewidth': 0.25,
          'lines.linewidth': 0.25,
          }
```

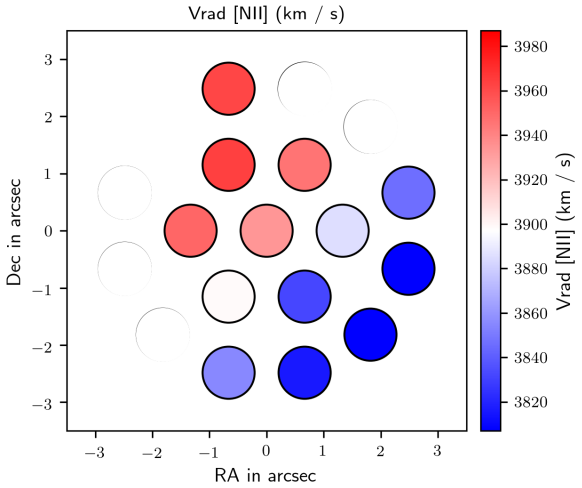
In [4]:
```
#Set plot environment with the parameters defined above
rcParams.update(params)
rcParams['font.family']=['sans-serif']
rcParams['font.sans-serif']=['Arial']

fig_params = {'figure.figsize': [fig_width, fig_height],
              'figure.subplot.left': 0.03,
              'figure.subplot.bottom': 0.04,
              'figure.subplot.right': 0.85,
              'figure.subplot.top': 0.96,
              'figure.subplot.hspace': 0.1}
rcParams.update(fig_params)
```

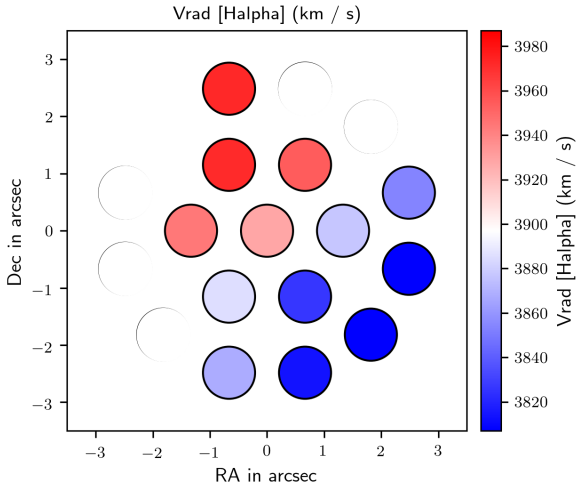
In [5]:
```
# Make a csv with the columns being beam number, x position of fiber, y
 position of fiber,
# velocities of [NII] (the bluer one), Halpha, [NII], [SII] (the bluer o
ne), [SII], then the
# other stuff
nm = '/Users/Lauren/Desktop/2018 2019 Senior/Sem 2/NGC7465/zw049.csv'
nb, x, y, halpha, niir, fwhmniir, fwhmHa, Halphaflux, niirflux = numpy.l
oadtxt(nm, delimiter=',', skiprows=0, unpack=True)

# Rotate hexpak positions of fibers
xtest = x*np.cos(30.*np.pi/180.)-y*np.sin(30.*np.pi/180.)
ytest = y*np.cos(30.*np.pi/180.)+x*np.sin(30.*np.pi/180.)
```

In [6]:
```
# mask for no data in Halpha and NII observed vel
badhnx = np.array([xtest[1],xtest[4],xtest[9],xtest[15],xtest[16]])
badhny = np.array([ytest[1],ytest[4],ytest[9],ytest[15],ytest[16]])

# mask for no data in fwhm delta v in NII
badNdvx = np.array([xtest[1],xtest[3],xtest[4],xtest[6],xtest[9],xtest[1
3],xtest[15],xtest[16]])
badNdvy = np.array([ytest[1],ytest[3],ytest[4],ytest[6],ytest[9],ytest[1
3],ytest[15],ytest[16]])

# mask for no data in fwhm delta v in Halpha, and flux counts
badHdvx = np.array([xtest[1],xtest[4],xtest[6],xtest[9],xtest[13],xtest[
15],xtest[16]])
badHdvy = np.array([ytest[1],ytest[4],ytest[6],ytest[9],ytest[13],ytest[
15],ytest[16]])

# mask for no data in flux counts [NII] and Halpha
badfluxx = badHdvx
badfluxy = badHdvy
```

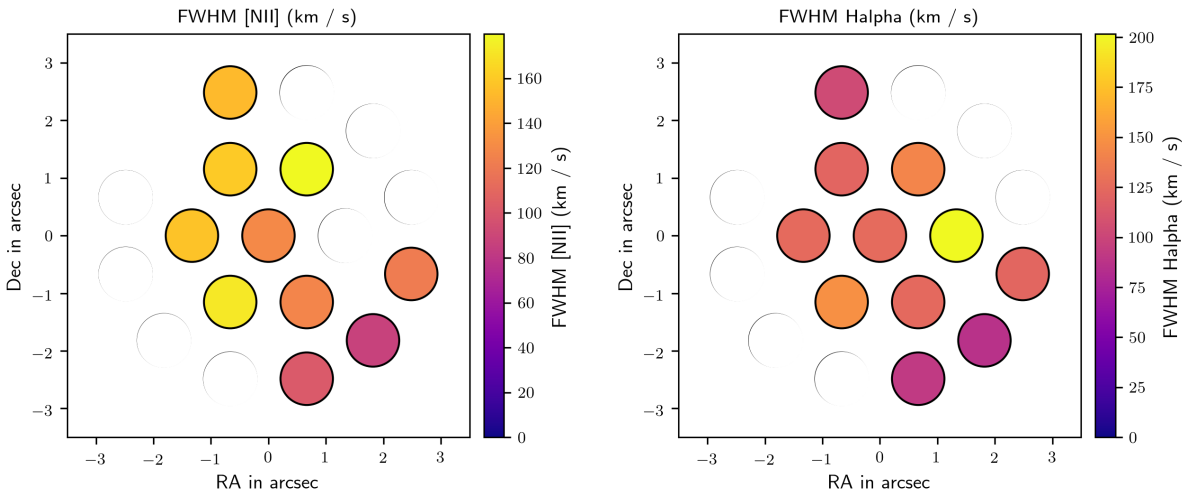
In [7]:

```
#Plot data
fig = plt.figure(figsize = (9,4), dpi=300)

# Plot the [NII] radial velocity
ax = fig.add_subplot(121)
ax.set_xlabel("RA in arcsec")
ax.set_ylabel("Dec in arcsec")
a1 = plt.scatter(x=xtest, y=ytest, c=niir, s=15**2 * math.pi, cmap='bwr'
, edgecolor='k',vmin=3807,vmax=3987)
# 3897 is used as the central velocity, from NED
plt.scatter(x=badhnx, y=badhny, color='w',s=15**2 * math.pi,edgecolor=
'w') # mask out bad data
ax.axis('equal')
ax.set_xlim([-3.5, 3.5])
ax.set_ylim([-3.5, 3.5])
ax.set_title("Vrad [NII] (km / s)")
div = make_axes_locatable(ax)
cax = div.append_axes("right", size="5%", pad = 0.1)
cbar = colorbar(a1, cax=cax)
cbar.set_label(r'Vrad [NII] (km / s)', rotation=90)


# Plot the Halpha radial velocity
ax2 = fig.add_subplot(122)
ax2.set_xlabel("RA in arcsec")
ax2.set_ylabel("Dec in arcsec")
a2 = plt.scatter(x=xtest, y=ytest, c=halpha, s=15**2 * math.pi, cmap='bw
r', edgecolor='k',vmin=3807,vmax=3987)
plt.scatter(x=badhnx, y=badhny, color='w',s=15**2 * math.pi,edgecolor=
'w') # mask out bad data
ax2.axis('equal')
ax2.set_xlim([-3.5, 3.5])
ax2.set_ylim([-3.5, 3.5])
ax2.set_title(r'Vrad [Halpha] (km / s)')
div = make_axes_locatable(ax2)
cax = div.append_axes("right", size="5%", pad = 0.1)
cbar = colorbar(a2, cax=cax)
cbar.set_label(r'Vrad [Halpha] (km / s)', rotation=90)


plt.subplots_adjust(hspace=0.2)
plt.subplots_adjust(wspace=0.4)
```


Vrad [NII] (km / s)
Dec in arcsec
RA in arcsec
Vrad [NII] (km / s)
3980
3960
3940
3920
3900
3880
3860
3840
3820


Vrad [Halpha] (km / s)
Dec in arcsec
RA in arcsec
Vrad [Halpha] (km / s)
3980
3960
3940
3920
3900
3880
3860
3840
3820

In [8]:
```
#Plot data
fig2 = plt.figure(figsize = (9,4), dpi=300)

# Plot [NII] fwhm (delta v)
ax3 = fig2.add_subplot(121)
ax3.set_xlabel("RA in arcsec")
ax3.set_ylabel("Dec in arcsec")
ax3.set_title("FWHM [NII] (km / s)")
a3 = plt.scatter(x=xtest, y=ytest, c=fwhmniir, s=15**2 * math.pi, cmap=
'plasma', edgecolor='k')
plt.scatter(x=badNdvx, y=badNdvy, color='w',s=15**2 * math.pi,edgecolor=
'w') # mask out bad data
ax3.axis('equal')
ax3.set_xlim([-3.5, 3.5])
ax3.set_ylim([-3.5, 3.5])
div = make_axes_locatable(ax3)
cax = div.append_axes("right", size="5%", pad = 0.1)
cbar = colorbar(a3, cax=cax)
cbar.set_label(r'FWHM [NII] (km / s)', rotation=90)

# Plot Halpha fwhm (delta v)
ax4 = fig2.add_subplot(122)
ax4.set_xlabel("RA in arcsec")
ax4.set_ylabel("Dec in arcsec")
ax4.set_title("FWHM Halpha (km / s)")
a4 = plt.scatter(x=xtest, y=ytest, c=fwhmHa, s=15**2 * math.pi, cmap='pl
asma', edgecolor='k')
plt.scatter(x=badHdvx, y=badHdvy, color='w',s=15**2 * math.pi,edgecolor=
'w') # mask out bad data
ax4.axis('equal')
ax4.set_xlim([-3.5, 3.5])
ax4.set_ylim([-3.5, 3.5])
div = make_axes_locatable(ax4)
cax = div.append_axes("right", size="5%", pad = 0.1)
cbar = colorbar(a4, cax=cax)
cbar.set_label(r'FWHM Halpha (km / s)', rotation=90)

plt.subplots_adjust(hspace=0.2)
plt.subplots_adjust(wspace=0.4)
```

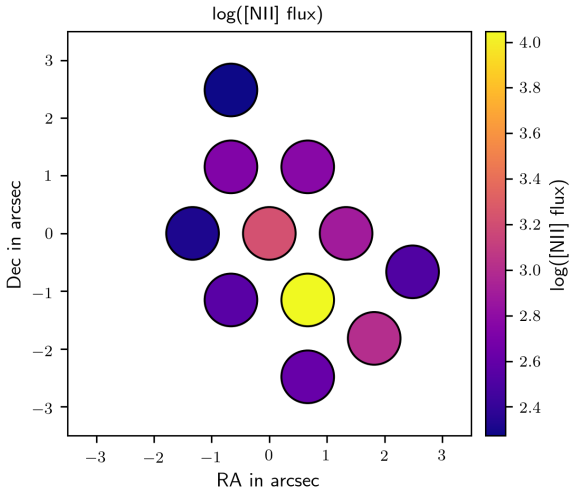


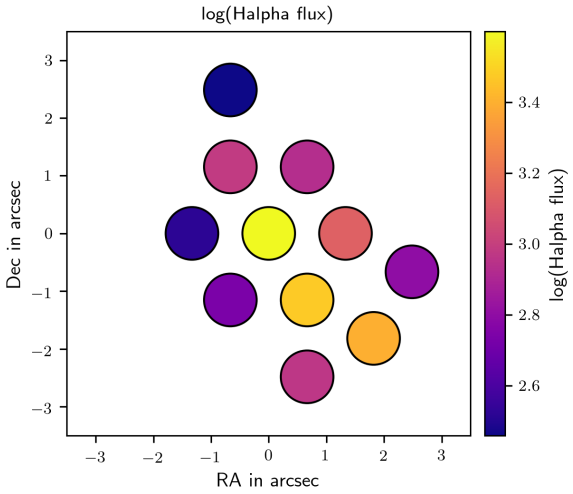
In [13]:

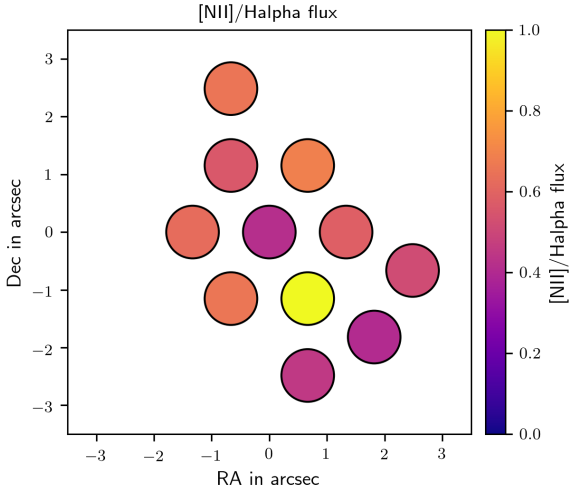
```
#Plot data
fig3 = plt.figure(figsize = (9,8), dpi=300)


ax5 = fig3.add_subplot(221)
ax5.set_xlabel("RA in arcsec")
ax5.set_ylabel("Dec in arcsec")
a5 = plt.scatter(x=xtest, y=ytest, c=np.log10(niirflux), s=15**2 * math.
pi, cmap='plasma', edgecolor='k')
plt.scatter(x=badfluxx, y=badfluxy, color='w',s=15**2 * math.pi,edgecolo
r='w') # mask out bad data
ax5.axis('equal')
ax5.set_xlim([-3.5, 3.5])
ax5.set_ylim([-3.5, 3.5])
ax5.set_title(r'log([NII] flux)')
div = make_axes_locatable(ax5)
cax = div.append_axes("right", size="5%", pad = 0.1)
cbar = colorbar(a5, cax=cax)
cbar.set_label(r'log([NII] flux)', rotation=90)


ax6 = fig3.add_subplot(222)
ax6.set_xlabel("RA in arcsec")
ax6.set_ylabel("Dec in arcsec")
a6 = plt.scatter(x=xtest, y=ytest, c=np.log10(Halphaflux), s=15**2 * mat
h.pi, cmap='plasma', edgecolor='k')
plt.scatter(x=badfluxx, y=badfluxy, color='w',s=15**2 * math.pi,edgecolo
r='w') # mask out bad data
ax6.axis('equal')
ax6.set_xlim([-3.5, 3.5])
ax6.set_ylim([-3.5, 3.5])
ax6.set_title(r'log(Halpha flux)')
div = make_axes_locatable(ax6)
cax = div.append_axes("right", size="5%", pad = 0.1)
cbar = colorbar(a6, cax=cax)
cbar.set_label(r'log(Halpha flux)', rotation=90)


ax7 = fig3.add_subplot(223)
ax7.set_xlabel("RA in arcsec")
ax7.set_ylabel("Dec in arcsec")
a7 = plt.scatter(x=xtest, y=ytest, c=(niirflux/Halphaflux), s=15**2 * ma
th.pi, cmap='plasma', edgecolor='k',vmin=0,vmax=1)
plt.scatter(x=badfluxx, y=badfluxy, color='w',s=15**2 * math.pi,edgecolo
r='w') # mask out bad data
ax7.axis('equal')
ax7.set_xlim([-3.5, 3.5])
ax7.set_ylim([-3.5, 3.5])
ax7.set_title(r'[NII]/Halpha flux')
div = make_axes_locatable(ax7)
cax = div.append_axes("right", size="5%", pad = 0.1)
cbar = colorbar(a7, cax=cax)
cbar.set_label(r'[NII]/Halpha flux', rotation=90)
```

```
plt.subplots_adjust(hspace=0.2)
plt.subplots_adjust(wspace=0.4)
```

```
/Users/Lauren/anaconda3/lib/python3.7/site-packages/ipykernel_launcher.
py:8: RuntimeWarning: divide by zero encountered in log10

/Users/Lauren/anaconda3/lib/python3.7/site-packages/ipykernel_launcher.
py:23: RuntimeWarning: divide by zero encountered in log10
/Users/Lauren/anaconda3/lib/python3.7/site-packages/ipykernel_launcher.
py:38: RuntimeWarning: invalid value encountered in true_divide
```







In [ ]:
```
#show()
#savefig('/home/tova/Documents/WIYNData/Python_Plotting/Zw049_Inner_NII_
FWHM.pdf')
```