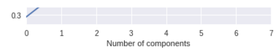
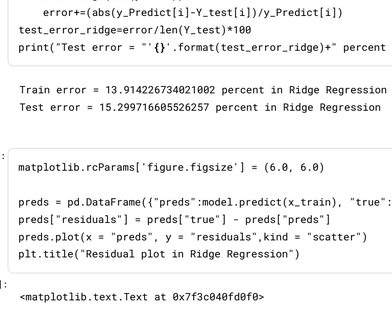
Comparing Regression Models



Since 5 components can explain more than 70% of the variance, we choose the number of the components to be 5

In [12]:
```
from sklearn.decomposition import PCA
sklearn_pca=PCA(n_components=5)
X_Train=sklearn_pca.fit_transform(X_std)

sns.set(style='darkgrid')
f, ax = plt.subplots(figsize=(8, 8))
# ax.set_aspect('equal')
ax = sns.kdeplot(X_Train[:,0], X_Train[:,1], cmap="Greens",
        shade=True, shade_lowest=False)
ax = sns.kdeplot(X_Train[:,1], X_Train[:,2], cmap="Reds",
        shade=True, shade_lowest=False)
ax = sns.kdeplot(X_Train[:,2], X_Train[:,3], cmap="Blues",
        shade=True, shade_lowest=False)
red = sns.color_palette("Reds")[-2]
blue = sns.color_palette("Blues")[-2]
green = sns.color_palette("Greens")[-2]
ax.text(0.5, 0.5, "2nd and 3rd Projection", size=12, color=blue)
ax.text(-4, 0.0, "1st and 3rd Projection", size=12, color=red)
ax.text(2, 0, "1st and 2nd Projection", size=12, color=green)
plt.xlim(-6,5)
plt.ylim(-2,2)
```

Out[12]:
```
(-2, 2)
```



In [13]:
```
number_of_samples = len(y)
np.random.seed(0)
random_indices = np.random.permutation(number_of_samples)
num_training_samples = int(number_of_samples*0.75)
x_train = X_Train[random_indices[:num_training_samples]]
y_train=y[random_indices[:num_training_samples]]
x_test=X_Train[random_indices[num_training_samples:]]
y_test=y[random_indices[num_training_samples:]]
y_Train=list(y_train)
```

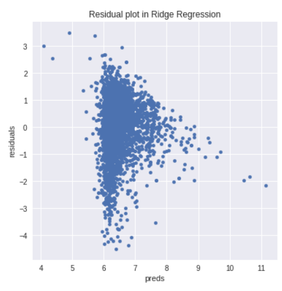
Ridge Regression

In [14]:
```
model=linear_model.Ridge()
model.fit(x_train,y_train)
y_predict=model.predict(x_train)

error=0
for i in range(len(y_Train)):
    error+=(abs(y_Train[i]-y_predict[i])/y_Train[i])
train_error_ridge=error/len(y_Train)*100
print("Train error = "'{}'.format(train_error_ridge)+" percent in Ridge Regression")

Y_test=model.predict(x_test)
y_Predict=list(y_test)

error=0
for i in range(len(y_test)):
    error+=(abs(y_Predict[i]-Y_test[i])/y_Predict[i])
test_error_ridge=error/len(Y_test)*100
print("Test error = "'{}'.format(test_error_ridge)+" percent in Ridge Regression")
```

```
Train error = 13.914226734021002 percent in Ridge Regression
Test error = 15.299716605526257 percent in Ridge Regression
```

In [15]:
```
matplotlib.rcParams['figure.figsize'] = (6.0, 6.0)

preds = pd.DataFrame({"preds":model.predict(x_train), "true":y_train})
preds["residuals"] = preds["true"] - preds["preds"]
preds.plot(x = "preds", y = "residuals",kind = "scatter")
plt.title("Residual plot in Ridge Regression")
```

Out[15]:
```
<matplotlib.text.Text at 0x7f3c040fd0f0>
```



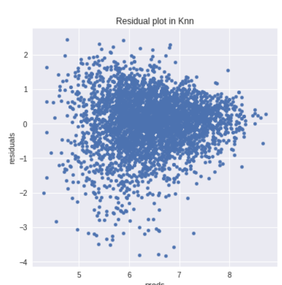
Knn Algorithm

In [16]:
```
n_neighbors=5
knn=neighbors.KNeighborsRegressor(n_neighbors,weights='uniform')
knn.fit(x_train,y_train)
y1_knn=knn.predict(x_train)
y1_knn=list(y1_knn)

error=0
for i in range(len(y_train)):
    error+=(abs(y1_knn[i]-y_Train[i])/y_Train[i])
train_error_knn=error/len(y_Train)*100
print("Train error = "+'{}'.format(train_error_knn)+" percent"+" in Knn algorithm")

y2_knn=knn.predict(x_test)
y2_knn=list(y2_knn)
error=0
for i in range(len(y_test)):
    error+=(abs(y2_knn[i]-Y_test[i])/Y_test[i])
test_error_knn=error/len(Y_test)*100
print("Test error = "'{}'.format(test_error_knn)+" percent"+" in knn algorithm")
```

```
Train error = 10.812937212714084 percent in Knn algorithm
Test error = 6.878221673331934 percent in knn algorithm
```

In [17]:
```
matplotlib.rcParams['figure.figsize'] = (6.0, 6.0)
preds = pd.DataFrame({"preds":knn.predict(x_train), "true":y_train})
preds["residuals"] = preds["true"] - preds["preds"]
preds.plot(x = "preds", y = "residuals",kind = "scatter")
plt.title("Residual plot in Knn")
```

Out[17]:
```
<matplotlib.text.Text at 0x7f3bfc306160>
```



Bayesian Regression

In [18]:
```
reg = linear_model.BayesianRidge()
reg.fit(x_train,y_train)
y1_reg=reg.predict(x_train)
y1_reg=list(y1_reg)
y2_reg=reg.predict(x_test)
y2_reg=list(y2_reg)

error=0
for i in range(len(y_train)):
    error+=(abs(y1_reg[i]-y_Train[i])/y_Train[i])
train_error_bay=error/len(y_Train)*100
print("Train error = "+'{}'.format(train_error_bay)+" percent"+" in Bayesian Regression")

error=0
for i in range(len(y_test)):
    error+=(abs(y2_reg[i]-Y_test[i])/Y_test[i])
test_error_bay=(error/len(Y_test))*100
print("Test error = "+'{}'.format(test_error_bay)+" percent"+" in Bayesian Regression")
```