In [2]:
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#uniformly distributed spherical coordinates
%matplotlib inline
import numpy as np
from mpl_toolkits.mplot3d import Axes3D
import matplotlib.pyplot as plt
import matplotlib
matplotlib.rc('xtick', labelsize=12)
matplotlib.rc('ytick', labelsize=12)

#first randomly select x, y, z in 3D cartesian coordinates
x = np.random.uniform(-1.,1.,5000)
y = np.random.uniform(-1.,1.,5000)
z = np.random.uniform(-1.,1.,5000)

# calculate the spheric radii and mark the
# random samples located within the unit sphere
r = x**2 + y**2 + z**2
ind = r<=1.

# these random samples follow the
# uniformly distribution in spheric coordinates
x1 = x[ind]
y1 = y[ind]
z1 = z[ind]

# transform the cartesian coordinates to spheric coordinates
#phi stands for the longitude
phi = np.rad2deg(np.arctan2(y1,x1))
#theta stands for the latitude
theta = np.rad2deg(np.arctan(z1/np.sqrt(x1**2+y1**2)))

# draw the samples at each step
fig = plt.figure(figsize=[10,10])
ax = fig.add_subplot(2,2,1, projection='3d')
ax.scatter(x,y,z,c='k',marker='+')
ax.set_xlabel('X',fontsize=20)
ax.set_ylabel('Y',fontsize=20)
ax.set_zlabel('Z',fontsize=20)

ax = fig.add_subplot(2,2,2, projection='3d')
ax.scatter(x1,y1,z1,c='k',marker='+')
ax.set_xlabel('X',fontsize=20)
ax.set_ylabel('Y',fontsize=20)
ax.set_zlabel('Z',fontsize=20)

ax = fig.add_subplot(2,2,(3,4))
ax.plot(phi,theta,'.k')
ax.set_xlabel(r'$\phi$',fontsize=20)
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ax.set_ylabel(r'$\theta$',fontsize=20)

fig.show()
fig.savefig('rand_spherical.png',bbox_inches='tight')
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