

Contact Force:

► Asperity Interaction (JKR)

$$\frac{4E^*a^3}{3R_e} - (8\pi a^3 \Delta\gamma E^*)^{0.5}$$

$$F = \iint \{ P_{JKR} + P_m + P_h \} dx dy$$

► Meniscus

$$-2\pi R_e \gamma_{lv} (\cos\theta_1 + \cos\theta_2)$$

► Hydration

$$2A_m \gamma_i e^{-(D-z)/\gamma_0}$$