

# Gravitation

G constant depends strength Force (G)

Newton's Shell thm. example some F, a different  
uniform matter attracts @ center  
law of gravitation  $F = G \frac{m_1 m_2}{r^2}$   
Everything attracts @ center

Principle  $F_{net} = \sum F_i$   
Superposition  $F_i = \int dF$   
NOTICE  
Direction  $F_{net} = \sqrt{(F_i)^2 + (F_j)^2} \dots$   
axis  $\rightarrow$  calculate each force

Surface  $F = G \frac{Mm}{r^2}$   
 $a_g = \frac{GM}{r^2}$   
 $g \neq a_g$  !!

Inside shell thm.  $F_{net} = 0$   
What if? uniform  
factors affecting... non-uniform, not rotating  
 $F_{gmax}$  @ surface inward  $\rightarrow$  decrease  
\* see notes

"tidal effect"

Head feet astronaut example  
acceleration  $a_f \rightarrow a_h$  slightly diff eq.  $dr = h$   
differentiate  $a_{ag} = -\frac{2GM_E}{r^3} dr$