

## *Why Testing the Equivalence Principle in Space? (II)*

- Torsion balance with the Sun as the source mass instead of the Earth

$$a_{EP}^{sun} \leq \frac{GM_{sun}}{D^2} \cdot \eta \cong 6 \cdot 10^{-3} \cdot \eta \quad m/s^2$$

modulation is provided by the 24-hr rotation of the Earth on which the balance sits

Dicke, Braginsky ....  $\eta \leq 10^{-11} \div 10^{-12}$

- Better if the measuring apparatus provides the modulation (e.g. torsion balance on a turntable)

"Eöt-Wash" experiments (Seattle)  $\eta \leq 10^{-12}$   
1÷2-hr Modulation

### *EP Violation Signal in Space*

- 2 Test bodies orbiting around the Earth at low altitude (Earth as source mass)

$$a_{EP} = \frac{GM_{\oplus}}{(R_{\oplus} + h)^2} \cdot \eta \cong 8.4 \cdot \eta \quad m/s^2$$

$$h = 520 \text{ km}$$

⇒ Effect in space 500 times stronger than on Earth if Earth is the source  
" 1400 " " if Sun is the source

- By being able to perform an EP experiment in space it is possible to gain 3 orders of magnitude in sensitivity. In addition, space is very well suited for small force measurements (weightlessness)



5 orders of magnitude improvement over ground based results is a realistic goal.