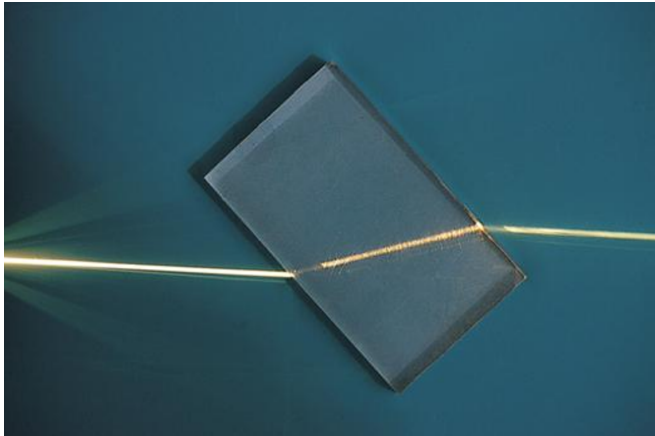


From Snell's law to minimum principles

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## FERMAT PRINCIPLE: LIGHT TRAVELS FOLLOWING THE PATH OF MINIMUM TIME



ALSO ANTS SEEM TO FOLLOW FERMAT'S PRINCIPLE!



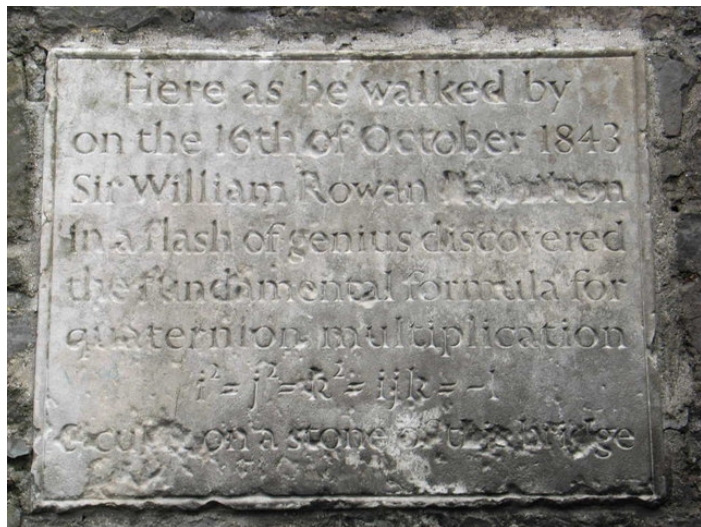
## FERMAT'S PRINCIPLE AND MIRAGE



STS 1 in Desert Mirage, Edwards AFB ~ 1981

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## QUATERNIONS ON BROOM BRIDGE



# NOETHER'S THEOREM: SYMMETRIES $\Longleftrightarrow$ CONSERVATION



*...Certainly one of the most important mathematical theorems ever proved in guiding the development of modern physics, possibly on a par with the Pythagorean theorem.*

– Leon M. Lederman and Christopher T. Hill