



James Binney

ASTROPHYSICS

A Very Short Introduction

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Chapter 1

Big ideas

In heaven as on Earth

Before Newton there was astronomy but not astrophysics. If legend is to be believed, astrophysics was born when Newton saw an apple drop in his Woolthorpe orchard and had the electrifying insight that the moon falls just like that apple. That is, a celestial body such as the moon does not glide on a divinely prescribed path through the heavens as Newton's predecessors supposed, but is subject to the same physical laws as the humble apple, which tomorrow will be a half-eaten windfall not worth picking up.

The power of this insight is that it allows us to apply physical laws developed in our laboratories to understand objects that exist on the far side of the universe. Thus Newton's insight enables us to travel in the mind across the inconceivable vastness of the universe to view a massive black hole at the centre of a distant galaxy from which radio telescopes have received faint signals.

Newton laid the foundations of astrophysics in another key regard: he showed that it is possible to obtain precise quantitative predictions from appropriately defined physical laws. Thus he did not only give a coherent physical explanation of observations that had already been made, but he *predicted* the results of