

Soft core splitting of normal modes and existence of finite rigidity in the Earth's liquid outer core

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We calculate normal modes for the Earth model, which has a slight rigidity layer at the base of the liquid outer core. We show that such a layer with thickness about 40 km and the shear wave velocity of 0.017 km/sec can produce a normal mode, which has a close eigenfrequency to that of liquid core model, without affecting fundamental modes and most of the higher modes.

This is basically the same as the soft core splitting reported by Sato (1964).

Our results indicate that the thin finite rigidity layer at the base of the outer core might explain the anomalous splitting of the Earth's normal modes, such as 3S₂, which has not been fully explained by the anisotropy in the inner core. We examine the physical significance of these soft core splitting modes. Our analysis shows that these modes can be interpreted as the modes which are trapped within the thin finite rigidity layer. The mode with the wavelength about 4/11 of the layer thickness has the same eigenfrequency with the 3S₂. This mode couples with the ordinary 3S₂ mode and appears as the soft core splitting.