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Exchange flow of two immiscible fluids and the principle of maximum flux RICH KERSWELL, Bristol University — The steady, coaxial flow in which two immiscible, incompressible fluids of differing densities move past each other slowly in a vertical cylindrical tube has a continuum of possibilities due to the arbitrariness of the interface between the fluids. Experiments clearly indicate that the realised exchange solution can vary depending on the viscosity ratio. By invoking the presence of surface tension to at least restrict the shape of any interface to that of a circular arc or full circle, we consider the following question: which flow will maximise the exchange when there is only one dividing interface. Surprisingly, the answer differs fundamentally from the better-known co-directional two-fluid flow situation.

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