

Jamie Foster

The reversing of interfaces in solutions to the porous medium equation with absorption

In this talk we shall consider the porous medium equation with absorption. This family of equations are widely used to model physical processes, for example, the spreading of viscous gravity currents, non-linear heat conduction and the dispersion of populations. It has been observed that, for suitable initial conditions, solutions have interfaces that change their direction of propagation. Although this phenomenon of reversing interfaces has been seen numerically, and some special exact solutions have been obtained there is little analytical insight into how this occurs in the general case. Here we aim to gain an analytical explanation of how interfaces reverse by looking for self-similar solutions local to the interface and local to the reversing time. This approach leads to a coupled pair of ODE problems that may be solved using a combination of analytical and numerical techniques. By solving these ODE problems we obtain a local solution to the family PDEs. Hence, new analytical insight is obtained into how an interface reverses. We also discuss the existence of reversing solutions and the types of reversing behaviour that can be exhibited by PDEs in the family of interest.