

# Large interaction problems for nonlinear elliptic and parabolic partial differential equations

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**Abstract** We discuss the behaviour of the nonlinear parabolic boundary value problem

$$\begin{aligned} u' &= d(1)\Delta u + f(u) - kuv \\ v' &= d(2)\Delta v + g(v) - kuv \end{aligned}$$

on a bounded domain  $D$  with homogeneous Dirichlet boundary conditions on the boundary of  $D$ . Here  $'$  is a partial derivative in time. We are also interested in the problem where the  $v$  in the last term of the first equation is replaced by its square (with a corresponding change in the second equation). We are mainly interested in the problem where  $k$  is large. We are also interested in similar systems of three or more equations. The first type of system occurs in population models while the second occurs in phase separation models. We are interested in the limiting behaviour of the stationary solutions and the behaviour of the dynamical system for large  $k$ . This is joint work with Kelei Wang and Zhitao Zhang.