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**John Paul Roop\*** (jroop@vt.edu), Department of Mathematics, 460 McBryde Hall, Blacksburg, VA 24061. *Diffusion Equations with Nonlocal Quadratic Nonlinearities.*

In this talk, we discuss nonlinear diffusion equations of the type

$$u_t + aD^{2\alpha}u - \nabla \cdot (u B(u)) = f, \tag{1}$$

where  $B(u)$  is a nonlocal (integral) operator, and  $D^{2\alpha}$  is a realization of a  $2\alpha$  order fractional dispersive operator (if  $1/2 < \alpha < 1$ ) or  $D^{2\alpha}$  is equal to  $(-\Delta)$  (if  $\alpha = 1$ ). Such equations have applications in physics (gravitational attraction), biology (chemotactic movements), etc. We present results and conjectures concerning the variational solution of (1) on bounded domains in  $R^d$  ( $d = 2$  or  $3$ ), as well as numerical experiments. (Received August 24, 2005)