

## Nonlinear electrodynamics, black holes and wormholes

K.A. Bronnikov

We consider spherically symmetric configurations in general relativity, supported by nonlinear electromagnetic fields with gauge-invariant Lagrangians depending on the single invariant  $f = F_{\mu\nu} F^{\mu\nu}$ . Static black hole (BH) and solitonic solutions are briefly described, both with only an electric or magnetic charge and with both nonzero charges (the dyonic ones). It is stressed that only pure magnetic solutions can be completely nonsingular. For dyonic systems, apart from a general scheme of obtaining solutions in quadratures for an arbitrary Lagrangian function  $L(f)$ , an analytic solution is found for the truncated Born-Infeld theory (depending on the invariant  $f$  only). Furthermore, considering spherically symmetric metrics with two independent functions of time, we find a natural generalization of the class of wormholes found previously by Arellano and Lobo with a time-dependent conformal factor. Such wormholes are shown to be only possible for some particular choices of the function  $L(f)$ , having no Maxwell weak-field limit.