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Feller generators with singular drifts in the critical range

I will discuss recent progress on a long standing problem of describing admissible singular drifts of Brownian motion. The first part deals with a sharp result on the magnitude of drift singularities that separates well-posedness from a blow up. This requires us to work, not quite expectedly, in appropriate "critical" Orlicz space (a rather compelling instance of the Lp theory). Informally, it turned out that strengthening appropriately the topology of the space where the Kolmogorov backward equation is considered allows to handle stronger singularities of the drift. This leads to the second part of the talk (joint with Yu.A.Semenov) on the Feller semigroup and a detailed well-posedness theory of the corresponding martingale problem for the entire subcrticial range of the mangitudes of singularities of the drift. The proof uses in a crucial manner some operator-theoretric techniques, such as Trotter's approximation theorem.