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In this talk I will focus on the deterministic and stochastic Zakharov-Kuznetsov (ZK) equation with multiplicative noise in a bounded domain in space dimensions two and three. ZK equation is a long-wave small-amplitude limit of the Euler-Poisson system of the cold plasma uniformly magnetized along one space direction. It is also a multi-dimensional extension of the Korteweg-de Vries (KdV) equation. The talk will focus on the well-posedness and regularity of the deterministic and stochastic ZK equation. In the deterministic case, the global existence of strong solutions is established in space dimension three. For the stochastic ZK equation driven by a white noise, the existence of martingale solution in 3D, and the uniqueness and existence of the pathwise solution in 2D are established. The major challenge is to handle the mixed features of the equation, including the partial hyperbolicity, nonlinearity, anisotropy, and stochasticity. The main idea is to split up the dissipative and dispersion effect of the equation and use them for different purposes. (Received September 05, 2019)