Partially magnetized plasma is a regime where the electron dynamics across the magnetic field are controlled by the magnetic field. The electron Larmor radius is much smaller than the macroscale (e.g., geometric scale of the domain or device size), while the ion Larmor radius is much larger. Ions are weakly affected by the magnetic field. Such regimes occur in parts of Earth’s ionosphere, the solar chromosphere, and collisionless shocks in space. In natural conditions, the electric field perpendicular to the magnetic field is often created due to the relative flow of the electrons and ions. In laboratory and technological plasmas, an external electric field perpendicular to the magnetic field is applied so that the ions can be extracted and accelerated by the electric field, while the electrons remain trapped by the magnetic field enhancing the discharge efficiency. Such cross-field (or ExB) discharges are widely used in magnetron sputtering devices for material processing and plasma electric propulsion such as Hall thrusters. Despite their long history, many aspects of ExB physics are only qualitatively understood precluding the predictive modeling of, for example, the next generation of Hall thruster for space propulsion or the theoretical prediction of ionosphere irregularities. Quantitative characteristics of nonlinear plasma instabilities, plasma turbulence, and associated anomalous transport remain poorly understood. Physics of instabilities and transport in partially magnetized ExB plasmas will be discussed, presenting recent advances in analytical theory and numerical approaches, and highlighting critical questions and problems.