Speaker: Ute Ebert (MAC3)
Title: Multiscale modeling of sparks and their kind

Abstract:
Sparks and lightning are not just fascinating phenomena. They also can be seen as energy converters: the input are high voltage pulses applied to ambient air or other gases, the intermediate stages are discharge channel trees, and the final product are light, thunder, particle and electromagnetic radiation, chemical conversion etc. The initial, so-called streamer stage seems to have by far the largest effects per input energy; present applications are disinfection and sterilization of air and water, combustion gas cleaning, biogas processing, high voltage technology, lightning protection, plasma medicine etc. Lightning related phenomena are investigated with the same methods. A key question in plasma technology is how to tune voltage pulses and electrode geometries such as to optimize the products.
MAC3 presently has 5 large STW-projects on these questions together with partners in experimental plasma physics and electrical engineering at TU/e and with a number of industrial users. MAC3 contributes through models of physical phenomena that span 5 different length scales. I will elucidate how we develop and solve computational models on different scales, merge them into hybrid codes and scale them up through analytical approximations. Hence both high performance multiscale computing and applied analysis are in our tool box. Intensive communication with experimenters is vital for the success as well.