Whereas studies of ion-surface interaction have been a significant issue in nuclear fusion research through about four decades, corresponding knowledge in the area of low-pressure plasma processing can still be considered as marginal. Qualitatively, it is well accepted that energetic ion bombardment is essential for several processes of low-pressure plasma surface treatment or plasma-assisted deposition of thin films. For the latter, it plays an important role in determining the growing thin film structure and stoichiometry. However, more quantitative models are only available for a few selected processes and for specific materials.

The lecture will briefly review the state of knowledge. It will particularly focus on the process physics of non-reactive and reactive magnetron sputtering. Open questions will be addressed in connection with recent experimental findings and computer simulation results, such as describing self-organized topographical and stoichiometric pattern formation under ion bombardment, and the characteristics of sputtering from such modified surfaces.

**Keywords**
- ion-surface interaction
- magnetron sputtering
- computer simulation
- ion-induced surface patterning