

PHYSIKALISCHES KOLLOQUIUM

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AIRBORNE WIND: HARVESTING HIGH-ALTITUDE WIND ENERGY WITH AUTONOMOUS DRONES

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Airborne Wind Energy (AWE) is the idea to harvest wind energy at high altitudes using autonomously controlled flying objects. Thus, very strong and consistent winds at many hundreds or even thousands of meters of altitude will become accessible, which are clearly inaccessible for conventional wind turbines. Although the AWE principle has been invented almost 40 years ago, up to now it was technically infeasible due to the demands on sensors for state estimation, computing for the autonomous control, and materials for building light strong structures. The advent of the age of digitisation and the age of drones has now opened a window to bring the digital revolution to sustainable energy production and to help saving the planet from our destructive effects.

The most fundamental design choice about an AWE device is the interesting question of how to transfer the harvested energy from a flying object to the ground. The most common approach is to use the wind force on the wing of the AWE device to pull a tether against the force of a generator on the ground. Even beyond that, many possibilities exist, each with their own challenges: e.g. rigid planes have a higher aerodynamic efficiency, soft kites are more forgiving. Small devices might be on the market soon, but still might need manual intervention, while big fully autonomous devices are necessary to compete on the electricity market.

The talk will give an overview of the physical foundations of AWE and show measurements and analyses of the wind resource highlighting the specific advantages of AWE. Then, I will review the state of the field in terms of some of its startups and their challenges. Finally, we will conclude with a few funny lessons from trying it out ourselves — the obligatory nose dive included.