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Vacuum ultraviolet time-resolved luminescence at P66 at DESY: instrument characteristics and applications

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In October 2024, P66 vacuum ultraviolet (VUV) time-resolved luminescence beamline marks three years of successful operation. Inheriting its main features from previous SUPERLUMI beamline at DORIS III storage ring [1], P66 is requested by leading scientists from more than 30 scientific groups around the world. Excitation and emission energy scans of the luminescence intensity within a unique excitation range of 3.7-40 eV, enabled by the ultrahigh vacuum conditions and added the time resolution down to circa 150 ps, employing the pulsed nature of the synchrotron radiation at DESY and fast detectors and electronics, make the setup a singular instrument to probe impurity/defect states, to determine the bandgap of dielectric materials and to unravel the energy relaxation and recombination mechanisms after VUV excitation. Absorbed by nearly all materials, VUV is a universal tool to study matter, in particular surfaces (the penetration depth of this radiation is circa 100 nm). An integrated cryostat provides a possibility to cool samples down to 8 K with the use of liquid helium, so even the weakest luminescence is enhanced, cutting away thermal relaxation processes. The applications of the method range from material science to fundamental physics: from fast scintillators for medical imaging and LEDs [2] to persistent phosphors for safety signs and luminophores for colour display panels are studied next to the first principles spectroscopy of nanophosphors [3].

References:

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