Direct electron microscope observations of radiation defects in materials

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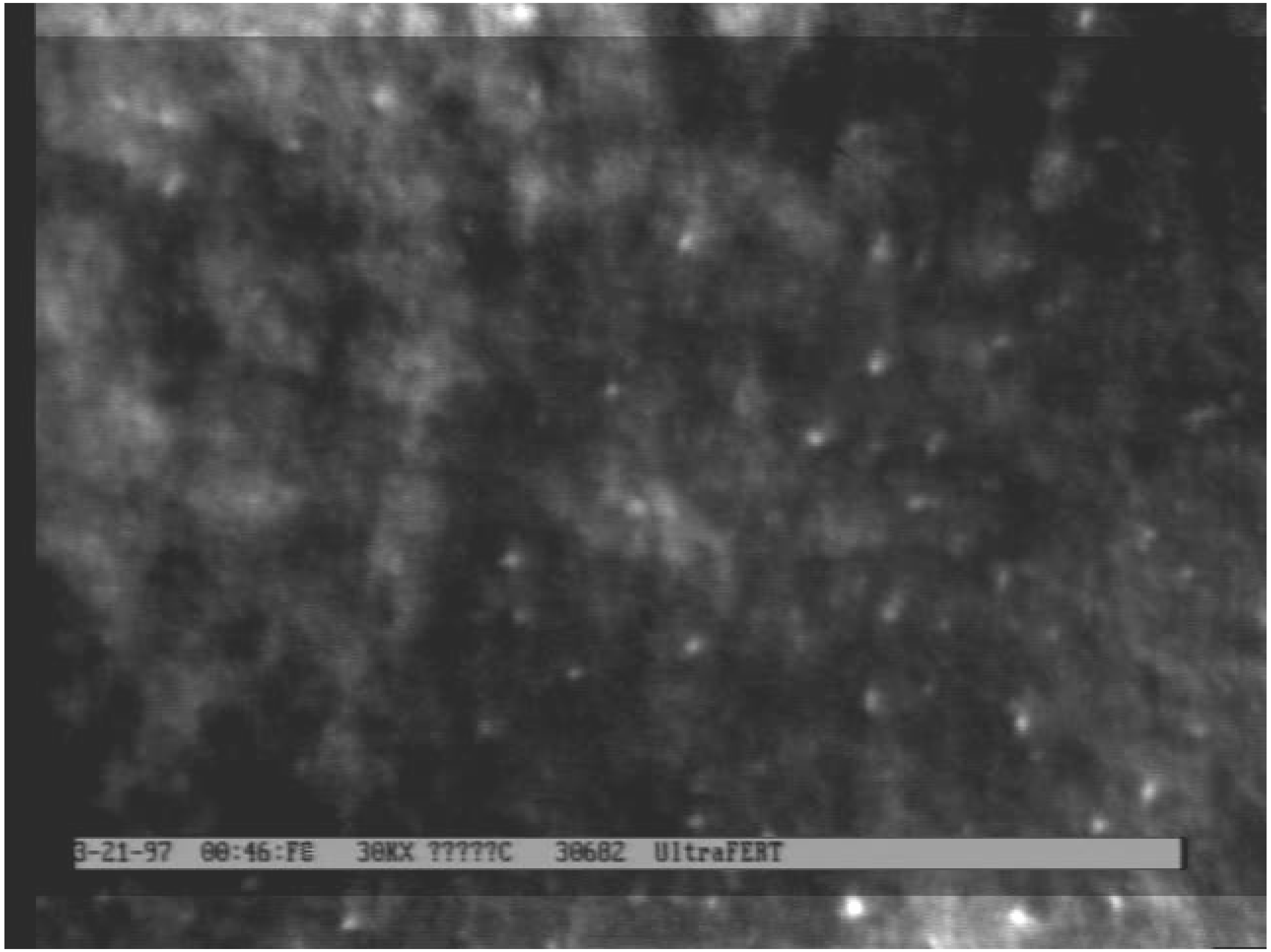
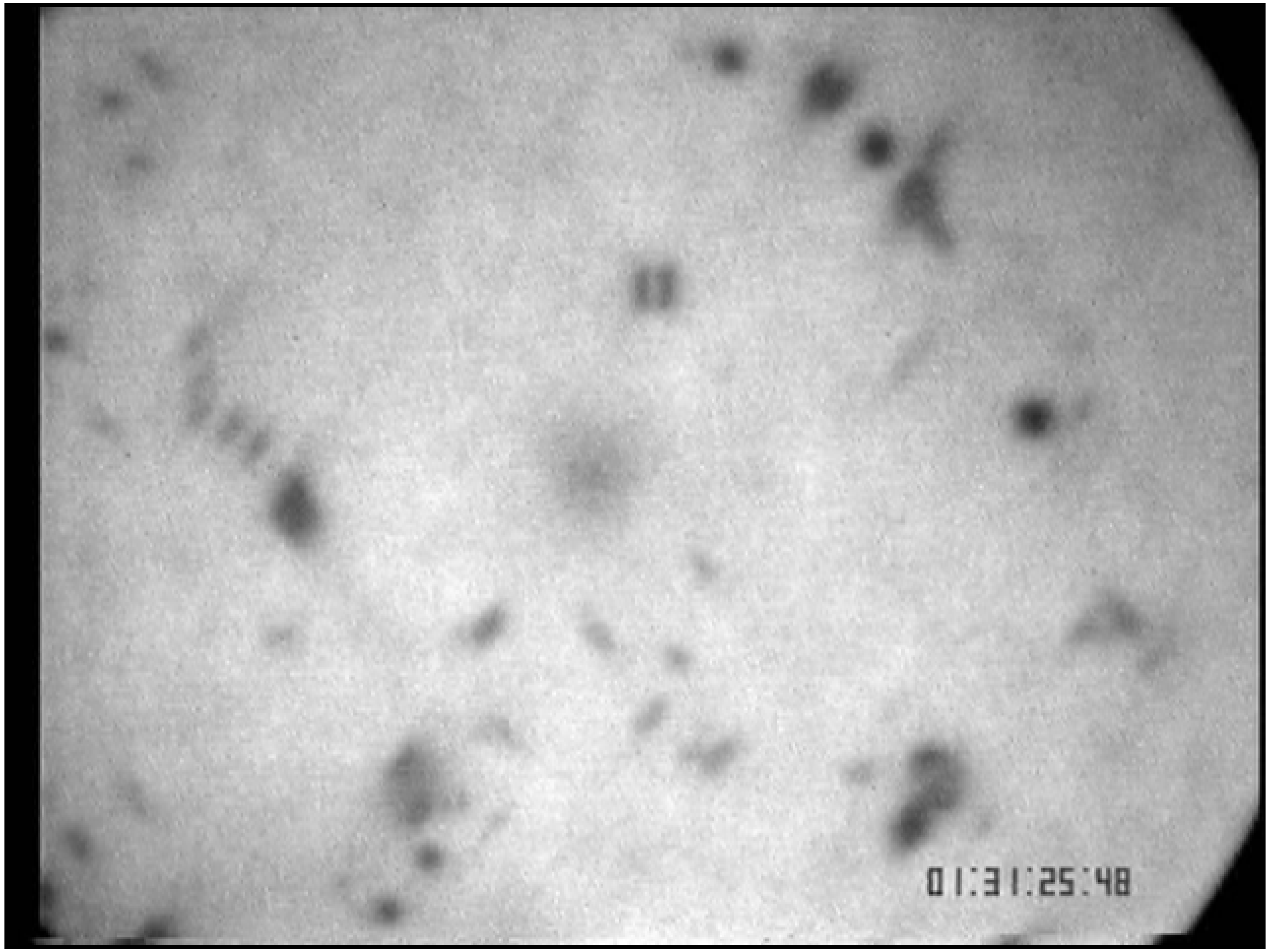
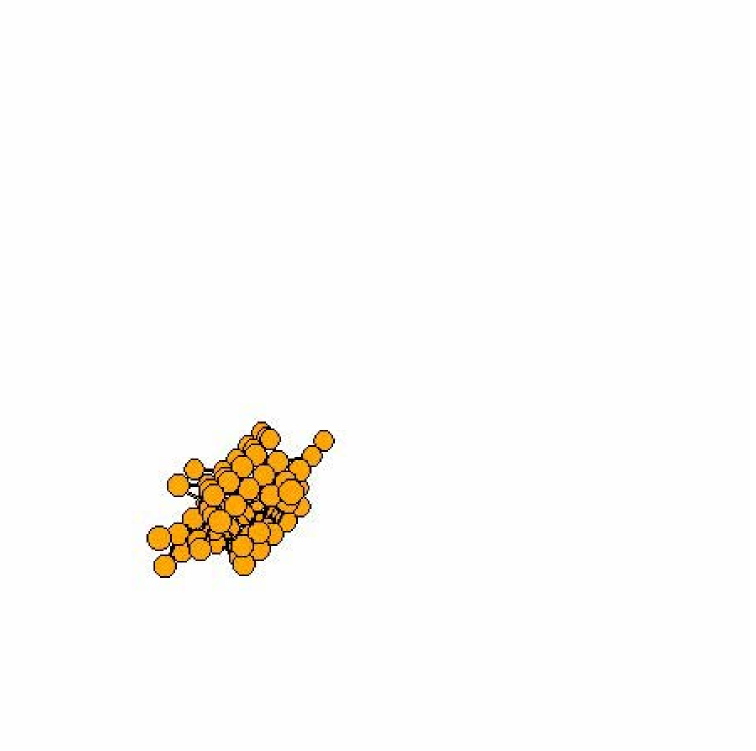


In-situ electron microscope observation showing the accumulation of radiation defects in ultra-pure iron under ion irradiation. Irradiation was performed at room temperature (courtesy of Z. Yao, M.L. Jenkins, and M. A. Kirk, Oxford University, UK).



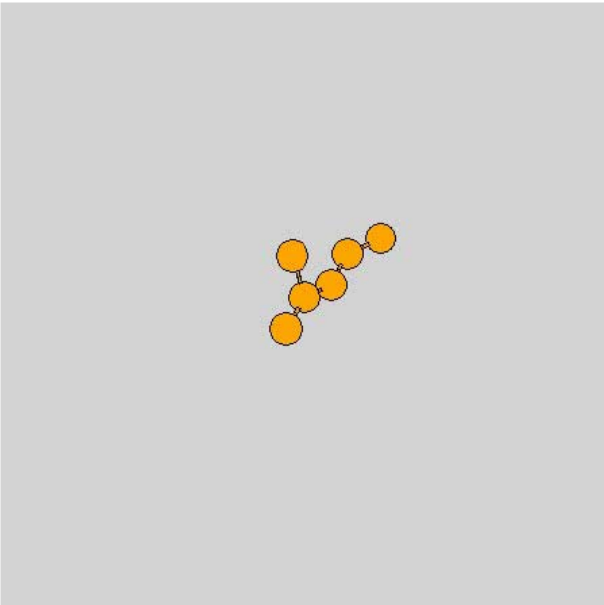
Thermally activated Brownian motion of **b**= a/2<111> prismatic dislocation loops in pure iron irradiated at 300°C (courtesy of K. Arakawa, Osaka University, Japan).

Brownian motion of radiation defects in pure metals



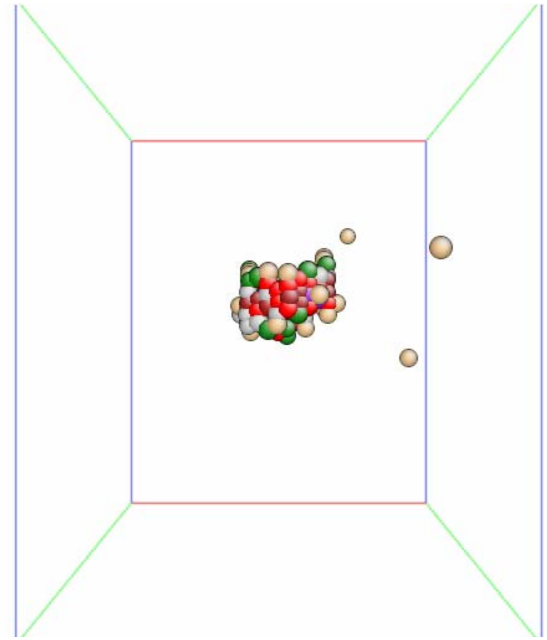
Thermal Brownian motion of nanoscale prismatic dislocation loops. Left: MD computer simulation. Right: *in-situ* electron microscope observation.

Brownian motion of radiation defects in pure metals



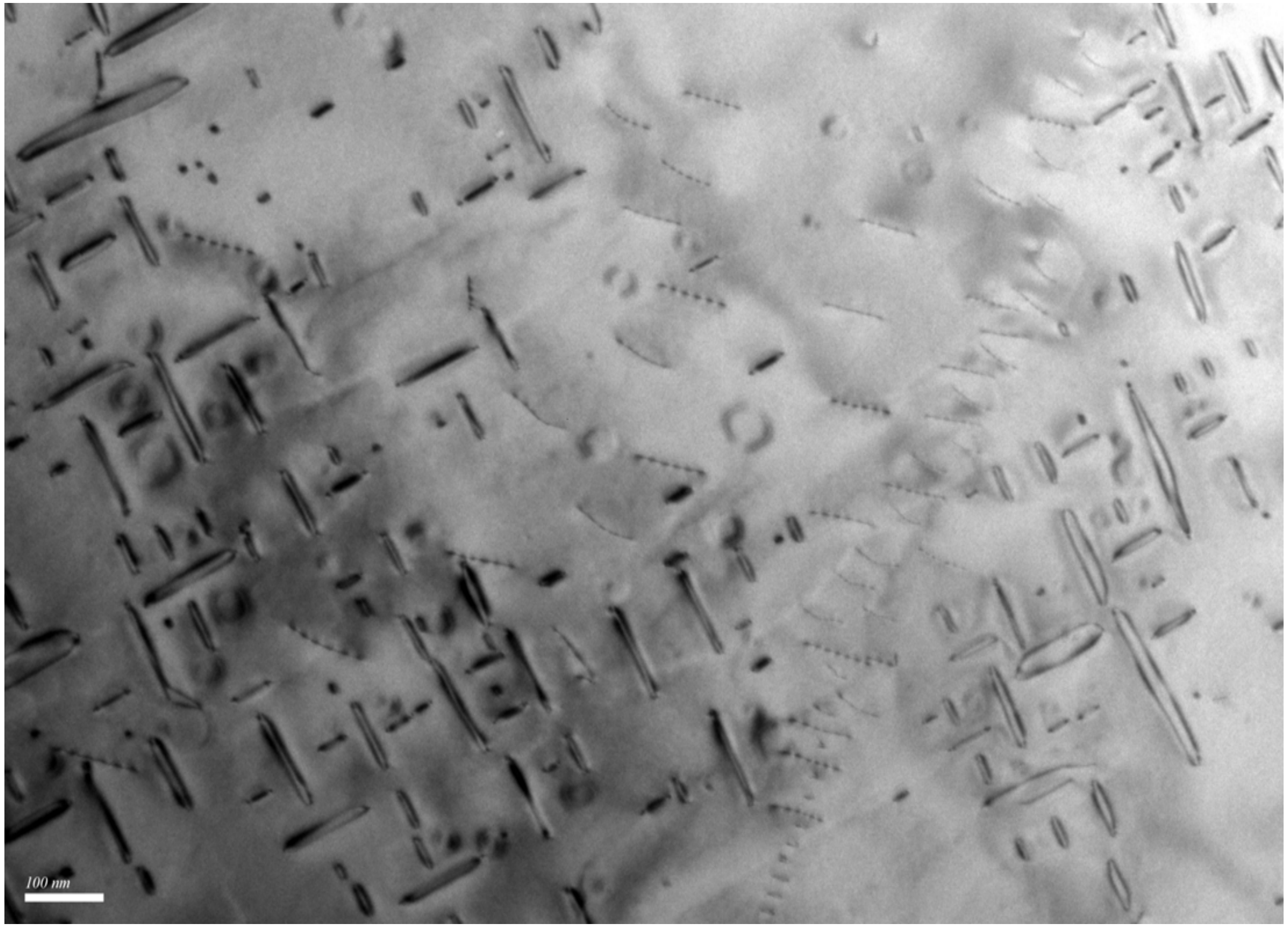
Fe: migration of a single 110 self-interstitial defect at 200°C.

W: migration of a single 111 self-interstitial defect at 500°C.



Fe or W: migration of a 61-atom self-interstitial atom cluster at 200°C.

Radiation defects produced by collision cascades in pure metals migrate very fast (migation velocities are in the 100 m/s range, and diffusion coefficients are of the order of ~10^{-9} m^2/s).



The immobile **b**=a<001> prismatic dislocation loops in bcc iron irradiated at 500°C (courtesy of Z. Yao, M. L. Jenkins and M. A. Kirk).

An ultra-high voltage electron microscope, Osaka University, Japan