Spectral properties of plasma mirrors generated by KrF lasers

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Short pulse KrF lasers are special as due to the short wavelength the interactions are nonrelativistic even if the intensity is as high as 10^{18} W/cm^2. The pedestals for these UV pulses (248 nm wavelength) originate from the ASE because the direct amplification. Now due to the new, Fourier filtering technique we could increase the contrast to 12 orders of magnitude, thus the 700 fs pulse interact with an initially steep, solid profile. Reflectivity of plasmas was investigated in a broad intensity range with different contrast beams. Although the absorption is higher for a low contrast radiation, it reaches >90% at 1.5×10^{18} W/cm^2 intensity for 45° angle of incidence even for the high contrast laser pulse. Reflected spectra show increasing Doppler blue shift from the counter-propagating plasma with increasing intensity. In case of high contrast the derived acceleration reaches a value higher than in earlier experiments with 1.6×10^{17}g. The blue shift shows a saturation tendency for the highest intensities, but no red shift could be seen which means that radiation pressure and $\mathbf{j}\times\mathbf{B}$ effects are negligible at these intensities. The spectrum of the reflected radiation shows a broadening at low intensities and for poor contrast laser pulses, but it will be narrower than the incoming laser pulse if the intensity is high. This observation refers to the nonlinear nature of this phenomenon, which can be explained either by the Brunel absorption taken into account or by the so-called block acceleration. In the same time the x-ray emission was also investigated and it was shown that – according to the expectations – for low-Z targets the emitted intensity is significantly weaker for the clean laser pulses due to the shorter scalelength of the plasma.