X-ray spectra diagnostics in laser plasma experiments

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The complete spectra of H and He-like ions of Si, O, and Na from laser produced glass microshell plasma in the wavelength range of 4–24 Å have been recorded with KAP and TlAP flat crystal spectrograph. Spatial resolved spectra diagnosis shows that the recorded lines predominatly contributed at ionization phase, and the different ionization state lines come from different regions in the plasma. In order to eliminate the diagnostic error introduced due to self-absorption of spectral lines, we utilize the relative intensity of H-like satellite lines to He-like statellite lines to obtain average electron temperature, electron density, ionization temperature and optical depth for the resonance lines under corona model.

The diagnosis indicate that during suppression of laser prepulse by adding dye cells in laser chain, x-ray emission, line broadening due to the source, and relative intensity of intercombination line to resonance line decrease, therefore average corona density increasing is concluded.

The compression of Ne-filled glass microballoons irradiated by two opposite laser beam has been measured directly by Stark broadening of spectrum of H-like Ne ions.

A few lines unidentified up to date occur in our x-ray spectrogram, and some prominent pseudo-lines result from oblique diffracting plane other than normal crystallographic plane.

激光等离子体 X 射线谱诊断

卢仁祥　殷光裕　范品忠　龚维燕

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用 KAP 及 TlAP 平晶X光谱仪拍摄到4～24 Å范围内玻壳等离子体所发射的硅、氧、钠的类氢和类氦离子的完整X光线谱。线谱诊断表明所记录到的线谱主要是离化时刻的发射，不同离子的线谱来自空间的不同区域。为了消除自吸收给线谱诊断带来的误差，在日冕模型前提下我们采用类氢离子伴线与类氦离子伴线的强度比来获得硅线发射区的平均电子温度及电子密度、离化温度及共振线的光学厚度。

线谱诊断也表明，当激光预脉冲由于放置染料盒而被抑制时，X射线发射减弱，源加宽减少，互组合线对共振线的相对强度减弱，从而推断冕区平均密度增加。

利用氖的类氢离子谱线的斯塔克加宽直接测量了二路激光对打充氖玻壳靶所产生的压缩。

在辨认谱线过程中发现了若干未曾报导过的谱线；某些“谱线”是那些与晶体切割面成一定夹角的晶面衍射产生的，而非指定切割面的衍射。