Electron channeling phenomena in electron microscopes are under the spotlight. The determination of site occupancies of select atoms in mineral structures is one of the most intriguing targets in mineralogy. The current extension of electron channeling spectroscopies using a transmission electron microscope (TEM) can provide the site occupancies of particular elements from a sub-micrometer area (Muto and Ohtsuka 2017). High angular resolution electron channeling X-ray spectroscopy (HARECXS) sheds light on the understanding of order-disorder transitions and kinematically controlled chemical reactions on the reaction front of the mineral formation process. In addition to spectroscopy, imaging can also be carried out using electron channeling phenomena. The electron channeling contrast from differently oriented grains of the same chemical composition is well known in backscattered electron (BSE) and forward scattered electron (FSE) images in conventional SEM imaging techniques (Reimer 1998). A rapid change in BSE intensity that occurs as the beam is scanned through the Bragg angle results from significant changes in the Bloch wave excitations (Joy et al. 1982; Kaboli et al. 2015). Electron channeling contrast imaging (ECCI) in a conventional field emission-scanning electron microscope (FE-SEM) has been applied to mineralogy as an alternative imaging tool for observing individual dislocations in rock-forming minerals (Miyajima et al. 2017). Analysis of forsterite deformation mechanisms has also been carried out with ECCI and electron backscatter diffraction (EBSD) (Kaboli et al. 2017; Kaboli et al. 2016). In the June issue of American Mineralogist, Igami et al. (2018) present a HARECXS study on Al/Si order-disorder in sillimanite as one of the most advanced applications of electron channeling spectroscopy.

**What is electron channeling?** Electron channeling is the anomalous interaction of incident electrons with a single crystal that is oriented under both a Bragg condition and zone axis condition. In the former setting, the electron beam is pseudo-parallel to the (hkl) crystallographic plane, which is called the “two-beam condition with $g = hkl$” in the TEM community. In the latter scenario, the beam is along the $<uvw>$ direction. Close to the Bragg orientation or along the zone axis, standing waves (Bloch waves) generated by the incident beam strongly interact with the crystallographic planes or atomic columns. Thus, electrons flow strongly along characteristic crystallographic planes, i.e., current densities related to electron inelastic interactions such as X-ray spectroscopy, electron energy loss spectroscopy (EELS), and BSE are strongly localized at the planes (planar channeling) or along the zone axis (axial channeling). Using the channeling effects in energy-dispersive X-ray spectroscopy (EDXS), the site and its occupancy by a particular element in the target crystal can be determined from the variations of X-ray intensity with changing crystal orientation, which is Atom Location by CHanneling-Enhanced Microanalysis (ALCHEMI) (Tafto 1982). The maximum channeling effect, i.e., maximum current density along a crystallographic plane (or atomic column) or the other plane (column), is controlled by a small deviation ($s$) of positive and negative value ($s > 0$ and $s < 0$, respectively) against the Bragg condition ($s = 0$).

To obtain planar channeling in TEM, precise crystal orientation alignment across a Bragg angle is necessary. Figure 1 shows three electron diffraction conditions for planar

![Figure 1](image-url)