Models of stellar evolution play a key role in a wide variety of research areas within astrophysics, including galaxy evolution, the properties of the first stars, supernova and GRB progenitor studies, and the hosts of extrasolar planets. Among their many applications, stellar evolutionary models are a key ingredient in stellar population synthesis codes, providing the key framework that is used to assemble a complete stellar population and track its temporal evolution. Ultimately, such codes are used to generate synthetic ionizing spectra, which can be directly compared to existing observations or used as inputs in photoionization codes to model the emission line spectra of HII regions and star-forming galaxies. Recently, a new grid of stellar models has been released that includes the first detailed implementation of stellar rotation effects. We have found that the inclusion of rotation has a substantial impact on the main-sequence lifetimes, luminosities, abundances, and effective temperatures of stars, producing a larger and hotter population of massive stars and strongly affecting the ionizing spectrum produced by such a population. By examining ionizing spectra generated with these rotating stellar evolutionary tracks and the Starburst99 stellar population synthesis code, we can evaluate the new stellar models and consider the strong influence that individual components of stellar physics can have on synthetic ionizing spectra and their applications.