Nonimaging optics departs from the methods of traditional optical design by instead developing techniques for maximizing the collecting power of illumination elements and systems. Nonimaging designs exceed the concentration attainable with focusing techniques by factors of four or more and approach the theoretical limit (ideal concentrators) allowing non-tracking solar concentrators to attain high temperature operation. Of special interest to the optics community is the deep connection between the “Hottel strings” introduced by MIT professor Hoyt C. Hottel and the flow-line algorithm of nonimaging optics design. We developed the XCPCs, which generate thermal energy by gathering and concentrating sunlight onto specially made collector tubes at the UC Solar Lab at UC Merced.

The latest external CPC collector (XCPC) is being used in Mongolia and Dubai with great success. XCPC’s offer a big cost advantage over solar collectors that require tracking mechanisms to follow the sun and they can also capture thermal energy on hazy or foggy days thanks to the wide-angle nonimaging optics design. In Ulaanbatar, one of the coldest cities on earth, with air quality best described as "smoke" high temperature operation was achieved during mid winter even in late afternoon. In Dubai, industrial scale operation was achieved at the largest sugar refinery in the world.

UC Solar, brings together scientists and engineers from all nine UC campuses in the quest to make solar the nation’s cheapest, cleanest energy option.

Dr. Roland Winston (Co-PI) is a Distinguished Professor and founding faculty member in the schools of Natural Science and Engineering at University of California at Merced (UC-Merced) and also Director of its Advanced Solar Technologies Institute. Dr. Winston's research and teaching focuses on concentrating solar energy systems and applied nonimaging optics. The concepts developed and the devices invented by Dr. Winston have formed the core of a new technology which carries the promise of making solar energy a truly viable energy source for society. Devices to which Winston’s name has become attached include the CPC itself, which is sometimes known as a "Winston solar collector" and "Winston cones", the individual parabolic elements that make up a CPC.

Practical applications can be found in photovoltaics, natural lighting of buildings, water heating, space heating and cooling, desalinization, cooking and in the collection of solar UV radiation for the photocatalytic treatment of contaminated wastewater. Nonimaging optics proved to be an important tool in several other areas including astrophysics, elementary particle physics, infrared physics and vision research. He has had over 200 articles published in scientific journals and over 60 patents.