



Melotte 15 courtesy Tolga Gumusayak  
FLI Kepler KL4040 camera

# Kepler KL6060 sCMOS Camera

Large Format

Low Noise

High Frame Rate



[www.flicamera.com](http://www.flicamera.com)  
USA 585-624-3760

# Maximize Your Field of View with our New Large Format Kepler KL6060 sCMOS Camera



Extremely  
Large Area



High Frame  
Rate



High  
Sensitivity



High Dynamic  
Range



Back-Illuminated (BI)  
& Front-Illuminated (FI)



High Performance  
& Reliability

## The New Low-Noise Cooled sCMOS Camera from Finger Lakes Instrumentation (FLI) Provides High Speed Imaging with an Exceptional Field of View

Available with a front-illuminated sensor or high-QE back-illuminated sensor, the Kepler KL6060 camera is capable of taking up to 19 frames per second, using the optional QSFP fiber interface. This affordable camera is a game-changing solution for Space Debris Detection and Space Situational Awareness applications and is ideal for universities or dedicated amateurs who want to capture every possible photon.

### SPECIFICATIONS

	Back-Illuminated (BI)	Front-Illuminated (FI)
Array Size	37.7 Megapixels	
Resolution	6144 x 6144 with 10 micron pixels	
Array Diagonal	86.8 mm	
Full Well Capacity (e <sup>-</sup> )	95k	128k
Read Noise	3e <sup>-</sup>	4.6e <sup>-</sup>
Frame Rate (QSFP)	11 fps	19 fps
Dynamic Range (HDR)	90 dB	89 dB
Electronic Shutter Type	Rolling	
Options	QSFP Fiber Interface 90 mm Shutter Liquid Cooling	

### High Frame Rates

The back-illuminated camera reads out at 14.288 microseconds per row (11 fps for full array). The front-illuminated camera reads at 8.533 microseconds per row (19 fps for full array). Faster imaging speed can be achieved by selecting a smaller region of interest. For example, by selecting a sub-array of 1,000 rows, frame rate increases by 6x.

### High Dynamic Range (HDR)

The KL6060 is able to capture bright and dim objects in a single image. It achieves a remarkable 90 dB dynamic range by reading a single exposure twice – once in high gain and once in low gain. FLI's proprietary algorithms guarantee the merged 16-bit HDR image is exceptionally linear, enabling high-precision quantitative analysis. FLI's Pilot software allows you to preserve the original 12-bit images for future scrutiny, ensuring that your original data remains unchanged.

### Optional QSFP Fiber Interface

When combined with the optional QSFP Fiber Interface, the KL6060 allows for long distance operation and isolation from electrical interferences. It also provides the highest data rates possible on the Kepler platform. Our PCIE interface supports customizable on-the-fly correction for Dark Signal Non-Uniformity and Photo Response Non-Uniformity at full data rates, including the ability for you to add the algorithms of your choice. Please contact FLI for details.

### Reliable, Long-Life Performance

The Kepler KL6060 is designed for use in the most remote locations and eliminates the need to periodically pump down the chamber or service desiccant cartridges. Our proprietary chamber design, coupled with decades of manufacturing experience, ensure that your camera will have a long lifespan, regardless of location.

### Support & Service

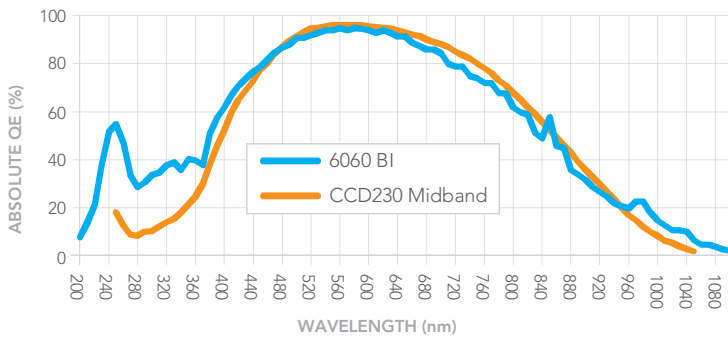
Each of our Kepler cameras are built for long-lasting sustainability and come standard with unrivaled service and support. They are field-programmable with the capacity to easily upgrade firmware and re-program from anywhere in the world. In addition, our shutters, power boards, and fans are simple field replacements, with no need for expensive, time-consuming transport back and forth from the factory. Our cameras are installed in observatories worldwide — many in remote mountaintop locations — from Antarctica to Fairbanks and Finland. See the back page of this brochure for a sampling of our satisfied customers.





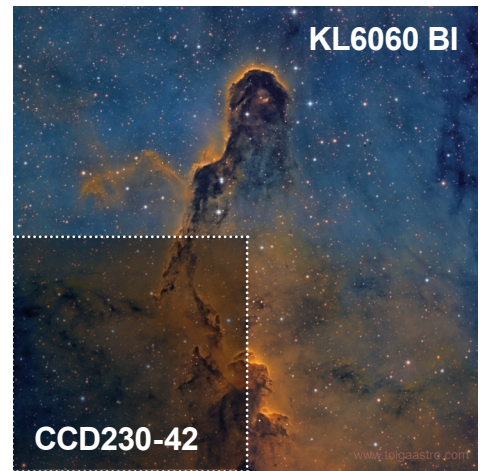
## Back-Illuminated sCMOS vs. Back-Illuminated CCD

**QUANTUM EFFICIENCY: KL6060 BI VS. CCD230 BI MIDBAND**



**DARK CURRENT:** At operating temperature, the KL6060 has ~1/3 the dark current of the popular CCD230-42 or CCD42-40 back-illuminated sensors.

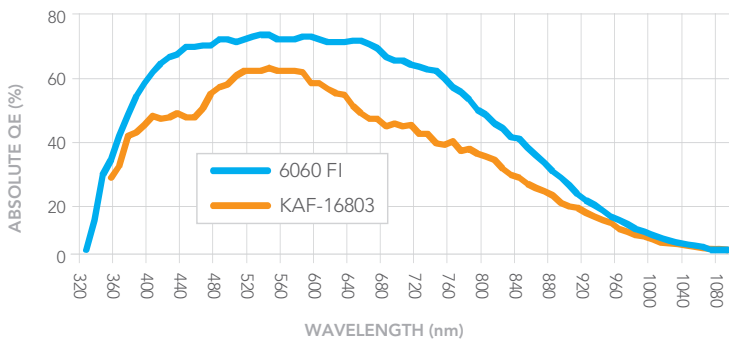
**READ NOISE:** The KL6060 BI has ~1/4 of the noise of the CCD230-42 running at 500 kHz (about 11 seconds readout time), but the KL6060 BI delivers 11 frames per second.



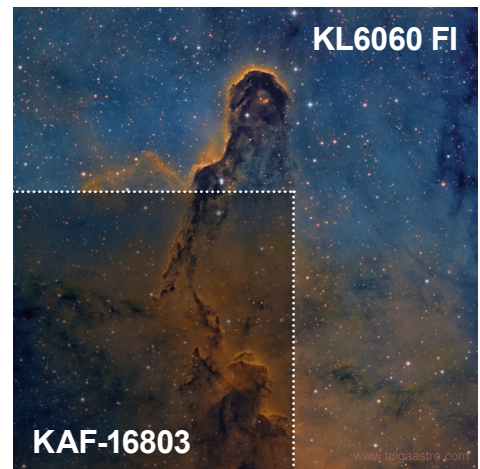
**FIELD OF VIEW:** With a diagonal of 86.8 mm, the KL6060 BI is comparable to the massive CCD230-84. The KL6060 sensor has 4X the FOV of the CCD230-42 and 5X the FOV of the CCD42-40.

## Front-Illuminated sCMOS vs. Front-Illuminated CCD

**QUANTUM EFFICIENCY: KL6060 FI VS. ON SEMI KAF-16803**



**READ NOISE:** The read noise of the KL6060 FI is 1/3 the noise of the KAF-16803 running at 8 MHz (about 3 second readout time), but the KL6060 FI delivers 19 frames per second.



**FIELD OF VIEW:** The KL6060 FI sensor has 3X the area of the KAF-16803 and 50% more FOV than a KAF-4320.

# Customers

Abastumani Observatory (Georgia) · Academia Sinica (China) · Adiyaman University (Turkey) · Adler Planetarium · Aerospace Corporation · Aiglon College (Switzerland) · Air Force Research Laboratory · Aix Marseille University (France) · American Museum of Natural History · Anadolu University (Turkey) · Andor Technology (UK) · Andrushivka Observatory (Ukraine) · Appalachian State University · Argonne National Lab · Arizona State University · Artem Observatory (Russia) · Auburn University · Austin College · Australian Astronomical Observatory · Australian Defence Science & Technology Organisation (DSTO) · Australian National University · Azdeniz University (Turkey) · Baader Planetarium (Germany) · Baku State University (Azerbaijan) · Ball Aerospace · Ball State University · Beijing Institute of Technology (China) · Beijing University (China) · Binghamton University · Boeing · Boston University · Brigham Young University · Butler University · California Institute of Technology · Carl Zeiss Jena · Carlton University (Canada) · Carnegie Institution for Science · Carnegie Observatories · Catholic University of America · Centro de Estudios de Física del Cosmos de Aragón (Spain) · Center for Research and Advanced Studies of IPN (Mexico) · Charité - Universitaetsmedizin Berlin (Germany) · China Academy of Space Technology · CICESE (Mexico) · City College of New York · Civil Aviation University (China) · CNRS (France) · Colby College · Connecticut College · Colgate University · Colleparado Observatory (Italy) · Colorado State University · Columbia University · Copernicus Foundation for Polish Astronomy · Cornell University · CSIR - Council for Scientific and Industrial Research (South Africa) · Cukurova University (Turkey) · Dartmouth College · DESY Deutsches Elektronen Synchrotron (Germany) · Drexel University · Duquesne University · Durham University (UK) · Edmund Optics · Egyptian Space Agency · Embry-Riddle Aeronautical University · Emirates Mobile Observatory (Abu Dhabi) · Emory University · EOS (Australia) · ETH Zürich (Switzerland) · European Molecular Biology Laboratory (Germany) · European Neuroscience Institute · European Southern Observatory (Germany) · Food & Drug Administration · Florida International University · Fordham University · Freie Universität Berlin (Germany) · Fudan University (China) · Geneva Observatory (Switzerland) · George Washington University · Georgia Institute of Technology · Georgia Public Health Lab · German Aerospace Center (DLR) · Getty Museum · Gissar Observatory (Tajikistan) · Goodrich · Guang Xi University (China) · Harvard University · Hefei Institute (China) · Helmholtz Centrum Geesthacht (Germany) · Hitachi · Horiba · Howard Hughes Medical Institute · Humboldt University of Berlin (Germany) · Institute of Molecular and Cell Biology (Singapore) · Institut d'Astrophysique de l'Université de Liège (Belgium) · Institut de Planetologie et Astrophysique de Grenoble (France) · Institute of Astronomy, Hawaii · Institute of Fluid Physics (China) · Institute of Mechanics, Chinese Academy of Sciences (CAS) · Institute of Physics (CAS) · Instituto de Astrofísica de Andalucía (Spain) · Instituto de Astrofísica de Canarias (Spain) · Instituto de Estudios Espaciales de Cataluña (Spain) · IPICYT (Mexico) · ITT Space Systems · IUCAA Pune University (India) · Japan Aerospace Exploration Agency (JAXA) · Jenoptik · Jet Propulsion Laboratory · Johns Hopkins University · Karlsruhe Institute of Technology (Germany) · Kitab Observatory (Uzbekistan) · Konkoly Observatory (Hungary) · Kopernik Observatory and Science Center · Korea Astronomy and Space Science Institute (KASSI) · Krasnojarsk Observatory (Russia) · Langkawi National Observatory (Malaysia) · Las Campanas Observatory (Chile) · Las Cumbres Observatory Global Telescope Network · Lawrence Berkeley Lab · Lawrence Livermore National Laboratory · LG Electronics (South Korea) · Lick Observatory · Leibniz Institute for Plasma Science (Germany) · Lockheed Martin · Lohrmann Observatory (Germany) · Los Alamos National Laboratory · Lowell Observatory · Macquarie University (Australia) · Maidanak Observatory (Uzbekistan) · Marine Biological Laboratory · Mauna Kea Observatory · Max Planck Institute (Germany) · Mayaki Observatory (Ukraine) · Mayo Clinic · McDonald Observatory · Memorial University of Newfoundland (Canada) · Miami University · Middlebury College · Milkovo Observatory (Russia) · Mississippi State University · MIT · MIT Lincoln Laboratory · Mitsubishi Electric · Mondy Observatory (Russia) · Montana State University · Mt. Sinai School of Medicine · NASA Ames · NASA Goddard · NASA Johnson · National Astronomical Observatories of China · National Astronomical Research Institute of Thailand/NARIT · National Institute for Astrophysics (INAF, Italy) · National Institute of Aeronautics and Space (Indonesia) · National Institute of Health · National Renewable Energy Laboratory · National Taiwan University · National University of Ireland · Nauchnyy Observatory (Ukraine) · Naval Ordnance Test Unit · Naval Research Laboratory · New Mexico State University · New Mexico Tech · New York State Dept. of Health · New York University · Nikon · NIST · Northrop Grumman · Northwestern Polytechnical University (China) · Northwestern University · Novosibirsk State University (Russia) · Observatoire de Oukaimeden (Morocco) · Observatorio Astronomico Nacional (Bolivia) · Observatory Hamburg (Germany) · Olympus · Oxford University (UK) · Palomar Observatory · Paul Scherrer Institute (Switzerland) · Pennsylvania State University · Physical Research Lab (India) · Pontificia Universidad Católica de Chile · Princeton University · Pulkova Observatory (Russia) · Purdue University · Purple Mountain Observatory (China) · Qatar Foundation · Raytheon · Reial Acadèmia de Ciències i Arts de Barcelona (Spain) · Rheinisch-Westfälische Technische Hochschule (Germany) · Rochester Institute of Technology · Royal Melbourne Institute of Technology (Australia) · Sandia National Laboratories · Sanglok Observatory (Tajikistan) · Scripps Research Institute · Seoul National University (South Korea) · SETI Institute · Shan Dong University (China) · Shanghai Institute of Technical Physics (China) · Shanghai Observatory (China) · Shumen University (Bulgaria) · Siding Spring Observatory (Australia) · Siemens · Simon Fraser University (Canada) · SLAC National Accelerator Laboratory · South African Large Telescope (SALT) · St. Francis Xavier University (Canada) · Stanford University · Sternberg State Astronomical Institute (Russia) · STFC (UK) · Sydney University (Australia) · Tarleton University · Technical Universities of Darmstadt, Dresden, and Ilmenau (Germany) · Technion University (Israel) · Tel Aviv University (Israel) · Tenagra Observatories · Terskol Observatory (Russia) · Texas A&M University · Texas State University · The Ohio State University · Tiraspol Observatory (Moldova) · Tubitak National Observatory (Turkey) · Turksat University (Turkey) · Tuskegee University · Universidad Nacional Autónoma de México · Universidad Nacional de La Plata (Argentina) · Università di Roma (Italy) · Universitat de Barcelona (Spain) · Universitat de Valencia (Spain) · Université de Montreal (Canada) · Universiteit Leiden (Netherlands) · Universities of Alabama, Alaska, Arizona, California, Central Florida, Chicago, Hawaii, Illinois, Iowa, Kentucky, Maryland, Massachusetts, Minnesota, Nevada, New Mexico, North Carolina, North Dakota, Notre Dame, Pittsburgh, Rochester, South Carolina, Texas, Virginia, Washington, and Wisconsin · Universities of Bremen, Duisburg, Freiburg, Göttingen, Heidelberg, Kiel, Konstanz, Magdeburg, Potsdam, and Würzburg (Germany) · University College Dublin (Ireland) · University Observatory Munich (Germany) · University of Bern (Switzerland) · University of Bradford (UK) · University of Calgary (Canada) · University of Dresden (Germany) · University of Jena (Germany) · University of Lethbridge (Canada) · University of Munich (Germany) · University of the Pacific · University of Quebec at Montreal, UQAM (Canada) · University of Newcastle (UK) · University of Queensland (Australia) · University of Toronto (Canada) · University of the Virgin Islands · University of Warwick (UK) · University of Western Australia · University of Western Ontario (Canada) · Upice Observatory (Czech Republic) · UPJS Institute of Physics (Slovakia) · US National Park Service · Ussurijsk Observatory (Russia) · Utah State University · Uzhgorod Observatory (Ukraine) · VA Hospital San Francisco · Victoria University of Wellington (New Zealand) · Virginia Tech · Washington and Lee University · Washington University in St. Louis · Wayne State University · Western Kentucky University · Wheaton College · Whitehead Institute of Biomedical Research · Whitman College · Williams College · Xi'an Institute of Optics and Precision Mechanics of CAS (XIOPM) · Xi'an University of Technology (China) · Xidian University (China) · Yale University · YBJ Observatory (Tibet) · Yunnan Observatory (China) · Zvenigorod Observatory (Russia)