Attila Kovács

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Employment

2026 —	**Physicist**, Max Planck Institute for Radio Astronomy (MPIfR), Bonn, Germany
2016 —	**Owner** (scientific consulting), Sigmyne LLC, Minneapolis, MN
2017 — **2026**	**Computer Engineer** (GS-14), Submillimeter Array (SMA) Center for Astrophysics | Harvard & Smithsonian, Cambridge, MA
2012 — **2016**	**Postdoc**, Submillimeter Technology Group, Caltech, Pasadena, CA
2009 — **2011**	**Postdoc**, University of Minnesota, Minneapolis, MN
2006 — **2009**	**Postdoc,** Max Planck Institute for Radio Astronomy (MPIfR), Bonn, Germany

Education

Ph.D. Physics, Caltech, Pasadena, CA, **2006**

Dissertation: SHARC-2 350 micron Observations of Distant Submillimeter-selected Galaxies and Techniques for the Optimal Analysis and Observing of Weak Signals

A.B. Physics, Astronomy & Astrophysics, Harvard College, Cambridge, MA, **1997**

Personality Type

ENTP-A

Interests

- Astronomical **instrumentation** and cryogenic **detector development**
- Highly **multiplexed** far-IR / mm-wave detector **readout systems**
- Distributed control & monitoring **systems**, e.g. for **telescope control**
- **Data reduction**, real-time **signal processing** (esp. on GPUs), numerical **algorithms**
- **AI** as a tool for increasing productivity and automation

Key Innovations

- **SuperSpec** lithographic filterbank spectrometer for the far-infrared
- far-IR data collection methods (e.g. **Lissajous** patterns) and data reduction (**CRUSH**) paradigms
- **GPU**-based chirp **readout** for Kinetic Inductance Detectors (**KID**s)
- **SMA-X** real-time database for structured data and metadata in distributed systems
- **SuperNOVAS** high-performance, high-precision, C/C++ astrometry library
- Spectral Energy Distribution (**SED**) **model** for power-law dust **temperature distributions**
- *P(D)* deep field **number counts modeling** through Bayesian inference

Key Projects

- **DR** pipeline for the **NASA / POEMM** mission, **NASA SOFIA / HAWC+** and **SOFIA / HIRMES**
- **Volumetric star-formation survey** of the universe with lithographic **IFU spectrometers**
- Astronomical **telescope control system** for the **MIT Haystack 37-m** telescope
- **Real-time** software **ecosystem** for the Smithsonian's Submillimeter Array (**SMA**)
- **Star-formation** in nearby galaxies and in the high-redshift Universe
- **Interferometric** on-the-fly (**OTF**) mapping with the **SMA**
- **Data reduction** and imaging for FIR cameras: **SHARC-2**, **SCUBA-2**, **LABOCA**, **GISMO**, **MAKO**
- **Readout** backend **software** for the **A-MKID** camera at the **APEX** telescope
- **µMUX** readout adapter interface for **BICEP3 / Keck** array at the South Pole
- Wide-RF / wide-IF **SIS mixer chip designs** for the CSO
- **SuperNOVAS** fast, modern, high-precision C/C++ astrometry library.
- **Open-source** contributor and **Linux packager** for Fedora / EPEL and Debian

Service

NASA APRA / SAT grant review panelist (2019, 2020) and panel chair (2021, 2023)
Journal referee for **ApJ**, **A&A**, **MNRAS**, **PASP**, **JLTP**, **JATIS**
SMA Time Allocation Committee (**TAC**) member (2019 — 2026)
Grant reviewer for **Fondecyt, Chile** (2009)

Impact Metrics

Papers: **94**	Citations: **6191**	Normalized Citations: **595**
h-index: **35**	*g*-index: **78**	*i10* index: **71**

Contributions, Duties & Responsibilities

2017 – 2026 **Center for Astrophysics | Harvard & Smithsonian**
(computer engineer, GS-14, Step 5)

– **Real-time Software Lead** of the **Submillimeter Array (SMA)** for a team of 4-6. Team: C. Moriarty, R. Rao, P. Grimes, R. Wilson, G. Keating, et al.

– Introduced and promoted modern software development tools, methods, standards, and best practices (e.g. GitHub, feature branching workflow, standardized build tools, deployment, continuous integration, static analysis, documentation standards).

– Lead the modernization of computer hardware & software systems at the telescope, in coordination with operators and engineers. Designed and implemented new telescope-wide data sharing system (**SMA-X**).

– Initiated and lead the planning, design, and implementation of software to enable and support new capabilities: **wSMA** receiver upgrades, interferometric on-the-fly (**OTF**) mapping, Solar observing mode, celestial holography, antenna computer upgrades, DDS upgrade.

– Lead the troubleshooting of software & (some) hardware issues (e.g. IF/LO systems, telescope drives, correlator, phase monitor, UPSes, network etc.), often working closely with engineers and operators in Hawaii (remotely).

– Lead maintainer of free open-source software (FOSS) packages for astronomy and telescopes, such as the **nom.tam.fits** Java library for handling FITS files, the **SuperNOVAS** C/C++ high-precision astrometry library, the **smax-clib** C/C++ library for real-time data sharing in distributed systems, the **RedisX** independent C/C++ client library for Redis / Valkey databases, and the **xchange** C/C++ library for structured data representation and JSON support.

– **SMA Time Allocation Committee** (TAC) member. Observing proposal review and rating.

– (2022 –) Contributor to the **APEX MKID** camera. Designed and implemented the unified backend software for the FFTS readouts, allowing precision readout tone control. Identified and developed solutions for DAC / ADC timing issues. Provided the physically motivated KID calibration model (for I,Q to total power conversion), developed the approach for optimizing KID readout power, provided diagnostics for up / downconverter LO issues, and contributed with insights to the optimization and troubleshooting of the entire system.

– (2019 – 2023) **NASA APRA / SAT** grant panelist (3 times) and panel chair (2023) for mm-wave and infrared detector technologies.

– (2019): I lead the diagnosis of the **APEX MKID** camera performance issues as an external consultant, identifying optical alignment, overdriven KIDs, and mirror deformities as the most likely causes of the problems. (The mirror deformities were confirmed at SRON afterwards).

– (2017 – 2018): Contributed to the **BICEP3 / Keck** array (PI: J. Kovac), by adapting the data acquisition system to work transparently with the experimental **μMUX** TES readout (PI: C. Yu), installing the new RFI scanner (on site), and troubleshooting issues prior to operation.

2017 – **Sigmyne, LLC** (independent scientific contractor)

– **NASA / POEMM Data Management Lead** (2025 – 2030): Leading the design of data systems, pathways, and processing. Team: V. Tolls (CfA), S. Maher (GSFC), R. Arendt (GSFC), V. Desai (IPAC). Solely responsible for the development of the on-board data reduction and instrument performance diagnostic pipelines, and the offline science pipeline, of the NASA / POEMM balloon mission (KIDs; PI: G. Stacey).

– **MIT Haystack 37-m Telescope** (2022 – 2023): Designed, developed, and implemented the new telescope control software ecosystem, to support operation for astronomy, enabling successful **VLBI / EHT** participation.

– **SOFIA/HIRMES** (2016 – 2019): Lead the development of the data format, designed and developed its spectral imaging pipeline (TES bolometers), and lead the simulator testing with team members S. Maher (GSFC) & R. Arendt (GSFC).

– **SOFIA/HAWC+** (2013 – 2018): Designed, developed, and implemented the scan-mode imaging pipeline (TES bolometers). Lead the design of the data format. Lead the push for the scan-mode polarimetry mode, working with C. Dowell (JPL) and M. Clarke (USRA). Contributed significantly to characterization, calibration, and commissioning as a member of the SOFIA/HAWC+ SI team.

Contributions, Duties & Responsibilities *(continued)*

2012 – 2016 **Caltech** (technology postdoc with Jonas Zmuidzinas)

– **GPU-based chirp readout for Kinetic Inductance Detectors (KIDs)**: Solely responsible for the concept, design, development, build, and implementation of this novel and unique KID readout solution (IF chain, amplifiers, filters, isolators, digital hardware, and software). Demonstrated with **CSO / MAKO-2** in May 2015, with performance that matched or exceeded the tone-based FPGA readout using polyphase filter banks.

– **CSO / MAKO** and **CSO / MAKO-2:** Solely responsible for the data reduction pipelines for the 350/850 um KID technology demonstration cameras. Lead the design and development of the data acquisition architecture, data format, and data protocols (with L. Swenson). Improved the KID calibration scheme with a more accurate accounting for nonlinearities. Developed a method for matching resonances to physical pixels dynamically during operation. Derived an optical distortion model for the curved focal plane. Lead the commissioning observations (observing plan, telescope setup, telescope / instrument control, pointing, focus, quasi real-time data reduction and diagnostics). Identified non-thermal recombination phonons as the source of the observed wide area cross-talk, and suggested thermalization and/or trapping a solutions.

– **SuperSpec**: Innovated the original spectrometer concept, and provided the initial circuit simulations with realistic material properties (e.g. dielectrics, loss-tangents, and fabrication tolerances). Contributed to the development of a prototype lithographic filterbank spectrometer (PI: C. Bradford) using Kinetic Inductance Detectors (KIDs) with ideas for improving the design and implementation, and performance (e.g. optical coupling). Contributed ideas for troubleshooting and improving the performance of the TiN KIDs, also under development.

– Contributed to the proposal and design of **CCAT** (the Cornell-Caltech Atacama Telescope), by identifying science drivers and the capabilities needed for these, and converting these into specs for the telescope (e.g. site altitude, aperture size, FoV, slewing speeds, scanning speeds, pointing accuracy) and the instrumentation (e.g. large mm-wave cameras, multi-beam spectroscopic capabilities, sampling rates).

– Lead the extragalactic surveys and SZ-cluster studies with the **GISMO** 2mm camera at the IRAM 30-m with J. Staguhn (GSFC) and T. Mroczkowski (Caltech).

– Developed an alternative (unofficial) data reduction pipeline for **JCMT / SCUBA-2** (850/350 μm), by reverse engineering the instrument configuration (pixel layout, optical distortion, subarray configuration, SQUID MUX scheme, pointing, PSF, pulse-tube notch filtering, detector noise properties) from publicly available data on planets and point sources.

2009 – 2011 **University of Minnesota** (independent postdoc)

– **SuperSpec** (2011): Co-proposed with Jonas Zmuidzinas the concept for lithographic on-chip filterbank spectrometers for the mm-wave bands (independently from DESHIMA).

– **IRAM / GISMO** (2009 – 2014): Solely responsible for the data reduction pipeline for the 2-mm camera for the 30-m telescope. I also lead the characterization, diagnostics, and troubleshooting (RFI, electronics, optics, stray light, blue leaks, telemetry, pointing model, He condensation), suggested solutions (improved grounding, cold baffle, neutral density filter, magnetic shielding, new mirrors, tweaked operating procedures) and instrument optimization (TES bias, observing modes), as part of core instrument team with J. Staguhn (PI; GSFC) and S. Maher (GSFC), improving sensitivity from ~65 mJy √s (before my contributions in 2009) to ~8 mJy √s (2014).

– I lead, designed, and conducted, studies of submillimeter and high-redshift radio galaxies, using **CSO / SHARC-2**, **IRAM / GISMO**.

– **APEX / PolKa** (2012 – 2015) G. Siringo (PI; ESO) and I demonstrated polarimetry with a rotating reflective half-wave plate using **APEX / LABOCA** at 870μm. I contributed innovative technical solutions for the waveplate calibration, time synchronization, and waveplate position tracking to make the instrument operational on a very tight schedule, and I was responsible for the first-of-its kind data reduction approach (novel algorithms).

– Designed, developed and implemented the **CRUSH-2** data reduction software tool for ground-based imaging cameras, capable of supporting a wide range of imaging instruments, and a successor to the more limited CRUSH-1 (for **CSO / SHARC-2**) and minicrush (**APEX** cameras).

Contributions, Duties & Responsibilities *(continued)*

2006 – 2009 **MPIfR** (postdoc with Karl Menten)

– Lead the characterization, diagnostics & troubleshooting (readout, grounding, microphonics, data acquisition, optics, stray-light, blue-leaks), and suggested solutions (changes to the readout electronics, detector bias and sampling, optical filtering, mirrors, alignment, additional thermometry) and commissioning of **APEX / LABOCA** 870μm (ion implant bolometer) and **APEX / SABOCA** 350μm (TES bolometer) cameras with E. Kreysa (PI), G. Siringo, W. Esch, N. Yethava, A. Weiss, and F. Schuller. I was instrumental in improving the sensitivity of LABOCA from ~10000 mJy √s (in 2006, before my contributions) to ~70 mJy √s (2007).

– Co-lead (with A. Weiss) the 870μm extragalactic surveys with **APEX / LABOCA**.

– Contributed to the **ATLASGAL** 870μm survey of the Galactic plane with **APEX / LABOCA**.

– Data reduction pipeline development for the **APEX** suite of cameras (**LABOCA** 870μm, **SABOCA** 350μm, **ASZCA** 2mm, **p-ArTeMiS** 350/450/870 μm). Developer of the **minicrush** data reduction pipeline (used by **ESO**).

– Designed and implemented the **APEXBridge** software, providing real-time digital anti-alias filtering and downsampling capabilities to any **APEX** instrument (and especially for **LABOCA**).

1997 – 2006 **Caltech** (PhD student with Tom Phillips and Jonas Zmuidzinas)

– (2002 – 2006) Operation of the **CSO / SHARC-2** 350μm camera, I provided its initial data acquisition software (**JSharc**), and the first-of-its-kind data reduction pipeline **CRUSH**. I conducted the follow-up observations of submillimeter galaxies (SMGs), and provided their first FIR characterizations for the SMG population. These studies and the data reduction approach (CRUSH) constituted my PhD thesis.

– (2001) **FIBRE**: Part of the team for the first light of this 350μm Fabry-Perot interferometer instrument (PI: D. Benford). I contributed with creative technical solutions during the one-and-only commissioning run which ultimately enabled the the first-light detection under very unfavorable conditions.

– (1999 – 2002) I created the **SIS mixer designs** for the new **CSO** receivers, using the **SuperMix**, providing ultra-wide RF (e.g. 180 – 320 GHz), and IF (0 – 12 GHz) bandwidths, with ~1 dB rms flatness, 3 dB conversion gain, with twin parallel junctions from JPL. Proposed the balanced mixer configuration to reject LO AM noise, the innovative IF tuning and matching networks on-chip for flat wide-IF performance, and using gold-plated mirrors instead of lenses within the cryostat to reduce receiver noise. I worked closely with J. Kooi. The measured receiver performances closely matched my simulations.

– (1997 – 2002) Development of the **SHARC-2** 350μm camera (NTD bolometers). I proposed its novel total-power readout scheme (first of its kind), with bias modulation / demodulation to overcome 1/*f* noise, experimented with various digital and analog anti-alias filtering schemes, tested components in the lab. Bolometer characterization of test devices, JFET amplifier testing. FTS measurements of materials for mm-wave characterization. Proposed the novel observing strategies (e.g. Lissajous scans, instead of the traditional chop-nod). Proof of concept for novel scan-mode data reduction technique, using both simulations and real data from the 24-pixel SHARC predecessor camera. Responsible for the digital signal processing, DSP hardware selection, and signal processing architecture.

– **CSO Observer**: Receiver tuning / optimization, analog PID chopper tuning, active surface operation, and lead observer. When things broke I tried to fix them on site if possible, e.g. by swapping out hardware components with available compatible spares.

1993 – 1997 **Harvard College** (undergraduate)

– (1996 – 1997) **Microwave laboratory spectroscopy:** Undergraduate research in the Thaddeus lab. I was the first to detect HC_7N, C_8H, and H_2C_5, and H_2C_6 in the laboratory, and providing characterization of their rotational spectra. I contributed to the optimization of the new FTS spectrometer instrument (tested different antenna designs, and placement, injection site, optimized valve and discharge timings), and wrote its data acquisition software.

Grants & Awards *(selected)*

NASA / POEMM Apr 2025 – Mar 2030
Title: Planetary Origins and Evolution Multispectral Monochromator
PI: Gordon Stacey (Cornell)
Budget: $ 20M
Role: Collaborator ($ 302,000)

NASA / SOFIA3G Dec 2016 – Dec 2021
Title: The High Resolution Mid-Infrared Spectrometer (HIRMES)
PI: Samuel H. Moseley (GSFC)
Budget: $ 17M
Role: Collaborator ($ 157,344)

NASA / SOFIA2G Jan 2013 – Dec 2016
Title: SOFIA wide-field far-IR polarimetry and fine-structure-line imaging with the HAWC+ upgrade
PI: C. D. Dowell (Caltech / JPL)
Budget: $ 10,832,000
Role: **Co-I** ($ 135,943)

NSF / AST (#1106284) Jul 2011 – Jun 2016
Title: A kilopixel, 2-color, TES-based bolometer camera for the IRAM 30 m telescope
PI: Johannes Staguhn (JHU/GSFC)
Budget: $ 861,059
Role: Collaborator

NASA / APRA (#10-APRA10-0158) Jan-2012 – Dec 2014
Title: Superconducting resonator spectrometer for mm- and submm-wave astrophysics
PI: C. M. Bradford (Caltech/JPL)
Budget: $ 1,495,100
Role: **Co-I** ($ 193,700)