EMC Spectrum Analyzer
*SPECTRAN® NF Series*
Affordable low-frequency Signal Analyzer

**References / examples of proof:**
- BOEING, USA
- NATO, Belgium
- Rohde & Schwarz, Belgium
- Shell Oil Company, USA
- ATI, USA
- Australian Government Department of Defence, Australia
- Daimler AG, Germany
- BMW, Germany
- Eurocontrol, Belgium
- DLR, Germany
- ThyssenKrupp, Germany
- Siemens AG, Germany
- PHILIPS, Netherlands

**Product of the year 2009**
Our 3D magnetic-field measurement coil with homogeneous centre won the *first price* of Europe’s biggest electronic newspaper “Elektronik” in the category passive components. This coil is installed in each NF-Spectran unit.
Specifications

**SPECTRAN® NF-1010E (10Hz to 10kHz)**
- Frequency range: 10Hz to 10kHz*
- Typ. level range E-Field: 1V/m to 2.000 V/m*
- Typ. level range H-Field: 10nT to 100.000nT*
- Typ. precision: 5% *
- REAL TIME FFT spectrum display
- High-performance DSP (Digital Signal Processor)
- 3D magnetic field measurement
- Frequency and signal strength display!
- High-resolution multi-function display
- DIN/VDE 0848 Exposure limit calculation!
- Internet Flash Software-Updates
- **USB 2.0 Interface**
- Simultaneous M-Display X, Y, Z axes
- Average (AVG) measurement
- PEAK Hold
- Incl. battery, charger & aluminum transportcase
- Dimensions (L/W/D): (260x86x23) mm
- Weight: 420gr
- **Warranty: 10 years**

**SPECTRAN® NF-3020 (10Hz to 400kHz)**
- Frequency range: 10Hz to 400kHz
- Typ. level range E-Field: 0,1V/m to 5.000 V/m
- Typ. level range H-Field: 1pT to 100.000nT
- Typ. precision: 5%
- Superfast FFT spectrum analysis
- High-performance DSP (Digital Signal Processor)
- 3D magnetic field measurement
- Simultaneous M-Display X, Y, Z axes
- True RMS signal strength measurement
- Average (AVG) measurement
- PEAK Hold
- Frequency and signal strength display
- High-resolution multi-function display
- "Clear text" signal identification
- DIN/VDE 0848 Exposure limit calculation
- Internal data logger
- Multi-function controls (single hand usage)
- USB 2.0 Interface
- Internet Flash Software-Updates
- Incl. battery, charger & aluminum transportcase
- **External SMA signal input**
- Dimensions (L/W/D): (260x86x23) mm
- Weight: 420gr
- **Warranty: 10 years**

**SPECTRAN® NF-5030 (1Hz to 1MHz / 20MHz / 30MHz)**
- Frequency range: 1Hz to 1MHz (30MHz)
- Typ. level range E-Field: 0,1V/m to 5.000 V/m at 50Hz
- Typ. level range H-Field: 1pT to 500µT at 50Hz
- Typ. level range Analog in: **200nV** to **200mV / -150dBm (Hz)**
- Typ. accuracy: 3%
- **65 MSPS**
- Lots of options
- NEW: 30MHz Option
- Superfast FFT spectrum analysis
- High-performance DSP (Digital Signal Processor)
- 3D magnetic field measurement
- Frequency and signal strength display
- High-resolution multi-function display
- DIN/VDE 0848 Exposure limit calculation
- Simultaneous M-Display X, Y, Z axes
- True RMS signal strength measurement
- Average (AVG) measurement
- Internal data logger
- Internet Flash Software-Updates
- USB 2.0 Interface
- Dimensions (L/W/D): (260x86x23) mm
- Weight: 420gr
- **Warranty: 10 years**

**SPECTRAN® NF-5030S (1Hz to 1MHz / 20MHz / 30MHz)**
- Identical to NF-5030, in addition:
- Vastly expanded measurement range
- Measurement range up to DIN/VDE 0848
- Typ. level range E-Field: **1V/m to 50 kV/m*** at 50Hz
- Typ. level range H-Field: **100pT to 20mT*** at 50Hz

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3311 Lewis Ave, Signal Hill CA 90755, 408-916-5750, www.reliantemc.com
CONFORMING TO STANDARDS

Measurement of electric and magnetic fields in this price range has never before been this professional. Find radiation sources in your surroundings. Find their respective frequencies and signal strengths, including direct display of exposure limits. This used to be impossible in this price category, professional units often costing several thousand euros and being excessively complicated in handling. The highly complex calculations in spectrum analysis incl. exposure limit calculation is being performed, unnoticed in the background, by a high-performance DSP (digital signal processor). This ultra-fast processor even allows, depending on the settings, REAL-TIME display with a NF-5030 (could you ask for more?).

Spectrum ANALYSIS

Professional EMF measurement devices use a frequency dependant measurement approach, the so-called spectrum analysis. In a certain frequency range, the individuals signals and their respective strengths are being broken down, for example into a "bargraph" display (see SPECTRAN® screenshot on the right). The height of the individual bars represents the corresponding signal strength. For the 3 strongest signal sources, SPECTRAN® can automatically displays the frequency and signal level, thanks to its "Auto Marker" feature. Of course, you can also setup the filter width and the frequency range to be analysed as you like.

In the EMF (LF) spectrum shown here, a frequency range of approx. 20Hz to 60Hz from left to right is being analysed. During analysis, the Auto Marker feature has determined - fully automatic - two main signal sources:

Signal#1=30Hz at 45µT
Signal#2=50 (mains power) at 75µT

LONG-TERM MEASUREMENT (Data logging feature)

SPECTRAN® measurement devices with data logger allow long-term recordings of measurement results over a freely adjustable period of time. This is particularly indispensable for serious evaluation of exposure by appliances and machinery which have a changing power consumption or radiation strength over time. Examples for these include railroads, power lines and plants, but also home appliances and their respective power cables, and various high-frequency transmission facilities like mobile phone transmission towers, mobile phones, radar etc. Depending on the time of day, considerable variation of exposure can occur (see attached graphics). Without long-term recordings, MASSIVE misinterpretation of total exposure can occur. With long-term data logging using SPECTRAN®, the daily variation of exposure can be recorded and analysed. Thus, the actual total exposure can be evaluated precisely. With this functionality, you can even discover sporadic EMC problems which would otherwise be very hard to detect.
Free PC Analysis Software „MCS“

The cross-platform Spectrum Analyzer Software MCS for Windows, Linux and MAC OS shows the full potential of the SPECTRAN units. The measurement results and controls work in realtime, which means without any delay between the reception and the display of the signal on a monitor.

- Works on all important operating systems like Windows, MAC OS and Linux
- Multi-Device capable, remote control function of several units which can be controlled simultaneously from the same PC
- Real-Time remote control with any Spectran Spectrum Analyzer
- Unlimited number of limits e.g. EN55011, EN55022, ICNIRP and more, inclusive limit lines and beam indicator as well as a special limit editor to create and save custom limits
- Multi window support
- Powerful Undo-Feature
- Customer-specific skins and color-settings
- Record and Replay function
- Advanced Trigger and alarm functions
- Unlimited number of markers
- Multiple views at the same time: Spectrum, Waterfall, Histogram, Limits, Chanelpower, Providerdisplay, Time Domain, Results...
- Personal sessions handling
- Simultaneous display of multiple units like dBm, dBµV, V/m, W/m² etc. with powerful autorange
- and many more features that are constantly evolving...

The new standard: 3D MEASUREMENT

Mismeasurement caused by wrongly adjusting the measurement device in space or troublesome and complex 3D calculations with a calculator are a problem of the past from now on, thanks to SPECTRAN® EMF (LF) measurement devices. All SPECTRAN® EMF measurement devices can measure magnetic fields directly in 3D! Starting with the SPECTRAN® NF-1010E, field strengths of the individual X, Y and Z axes can even be shown separately. This has become possible thanks to the newest development from the Aaronia laboratories: Our high-tech REAL 3D miniature sensor coil. Consisting of a specially crafted nylon base with 3 independent windings made of ultra-thin, 0,05 mm² wire, it impresses with its extremely high sensitivity. It allows measurement of magnetic fields in all 3 spatial dimensions. The signal processor (DSP) of the SPECTRAN® performs the resulting highly complex calculations. You receive 3D measurement results which can otherwise only be achieved by using highly professional equipment.

INCLUDED WITH DELIVERY

- LF spectrum analyser SPECTRAN NF-50xx
- Sturdy aluminum-design carrycase (with custom padding!)
- 1300mAh Aaronia power battery with charger
- PC Software MCS (on CD)
- Exhaustive manual with lots of basic information, hints and exposure limit tables (PDF file)
**SPECTRAN® NF (EMF) Spectrum Analyser**

**APPLICATION EXAMPLES:** Traction power, power lines and cables incl. harmonics, transformer, switching power supplies, RFID, TFTs, DSL etc. Various appliances in home and office.

### SPECIFICATIONS BASE UNIT

<table>
<thead>
<tr>
<th>Feature</th>
<th>NF-1010E</th>
<th>NF-3020</th>
<th>NF-5030</th>
<th>NF-5030X</th>
<th>NF-XFR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency Range (min)</td>
<td>10Hz</td>
<td>10Hz</td>
<td>1Hz</td>
<td>1Hz</td>
<td>1Hz</td>
</tr>
<tr>
<td>Frequency Range (max)</td>
<td>10kHz</td>
<td>400kHz</td>
<td>30MHz</td>
<td>1MHz</td>
<td>30MHz</td>
</tr>
<tr>
<td>Electric field [V/m] (min) (typical)</td>
<td>1V/m</td>
<td>1V/m</td>
<td>0.1V/m</td>
<td>see opt.PBS2</td>
<td>see opt.PBS2</td>
</tr>
<tr>
<td>Electric field [V/m] (max) (typical)</td>
<td>2.000V/m</td>
<td>5.000V/m</td>
<td>5.000V/m</td>
<td>see opt.PBS2</td>
<td>see opt.PBS2</td>
</tr>
<tr>
<td>Magnetic field [Tesla] (min) (typical)</td>
<td>1pT</td>
<td>1pT</td>
<td>1pT</td>
<td>see opt.PBS2</td>
<td>see opt.PBS2</td>
</tr>
<tr>
<td>Magnetic field [Tesla] (max) (typical)</td>
<td>100µT</td>
<td>100µT</td>
<td>500µT</td>
<td>see opt.PBS2</td>
<td>see opt.PBS2</td>
</tr>
<tr>
<td>Magnetic field [Gauss] (min) (typical)</td>
<td>10nG</td>
<td>10nG</td>
<td>10nG</td>
<td>see opt.PBS2</td>
<td>see opt.PBS2</td>
</tr>
<tr>
<td>Magnetic field [Gauss] (max) (typical)</td>
<td>1G</td>
<td>1G</td>
<td>5G</td>
<td>see opt.PBS2</td>
<td>see opt.PBS2</td>
</tr>
<tr>
<td>Analog input [V] (min) typical</td>
<td>-</td>
<td>2µV</td>
<td>200mV</td>
<td>200mV</td>
<td>200mV</td>
</tr>
<tr>
<td>Analog input [V] (max) typical</td>
<td>-</td>
<td>200mV</td>
<td>2V</td>
<td>2V</td>
<td>2V</td>
</tr>
<tr>
<td>RBW (resolution bandwidth) (min)</td>
<td>1Hz</td>
<td>1Hz</td>
<td>0.3Hz</td>
<td>0.3Hz</td>
<td>0.3Hz</td>
</tr>
<tr>
<td>RBW (resolution bandwidth) (max)</td>
<td>3kHz</td>
<td>100kHz</td>
<td>1MHz</td>
<td>1MHz</td>
<td>1MHz</td>
</tr>
<tr>
<td>Demodulator</td>
<td>-</td>
<td>AM</td>
<td>AM/ FM</td>
<td>AM/FM</td>
<td>AM/FM</td>
</tr>
<tr>
<td>Units (additional units via PC software)</td>
<td>V/m, T, G</td>
<td>V, V/m, T, G</td>
<td>V, V/m, T, G, A/m</td>
<td>V, dBV</td>
<td>V, dBV</td>
</tr>
<tr>
<td>Detector</td>
<td>RMS</td>
<td>RMS/MinMax</td>
<td>RMS/MinMax</td>
<td>RMS/MinMax</td>
<td>RMS/MinMax</td>
</tr>
<tr>
<td>Internal Datalogger (size). Expandable to 1MB (option 001)</td>
<td>-</td>
<td>64K</td>
<td>64K</td>
<td>-</td>
<td>harddisk</td>
</tr>
<tr>
<td>FFT resolution (points)</td>
<td>64</td>
<td>64</td>
<td>1024</td>
<td>1024</td>
<td>1024</td>
</tr>
<tr>
<td>Lowest Sample Time</td>
<td>50mS</td>
<td>50mS</td>
<td>10mS</td>
<td>10mS</td>
<td>10mS</td>
</tr>
<tr>
<td>Accuracy (typical)</td>
<td>5%</td>
<td>5%</td>
<td>3%</td>
<td>3%</td>
<td>3%</td>
</tr>
</tbody>
</table>

### HIGHLIGHTS

- **Real-time remote control via USB**: Yes
- **Integrated electric (E) & isotropic magnetic (H) sensor/antenna**: Yes
- **3D, 2D or 1D mode switchable (only magnetic field sensor)**: Yes
- **Calibration setup (selected antenna)**: Yes
- **Exposure limit calculation according to ICNIRP, BGV B11, BlmSchV etc.**: Yes
- **Extended full ICNIRP range**: No
- **Suitable for Pre-Compliance test**: No
- **Real-time limit calculation with simultaneous percentage display**: Yes
- **Vector power measurement (I/Q) and True RMS**: No
- **Enhanced DFT spectrum analysis**: Yes
- **Simultaneously displays frequency and signal strength**: Yes
- **Up to 3 marker (showing both frequency and field strength)**: No
- **Jog Dial controlled manual marker readout**: Unlimited
- **Linear or logarithmic spectrum display (log10, log100, log1000)**: No
- **Automatic reference level adjustment (switchable)**: Yes
- **Hold function**: Yes
- **Free of charge firmware update (via Internet)**: Yes
- **Supports programming of custom P-Code & C++ based custom software**: Yes
- **High performance DSP (Digital Signal Processor)**: Yes
- **Large, high resolution multifunctional LCD (95mm)**: Yes
- **Spectrum display (51x25 pixel)**: Yes
- **High resolution 50 segment bargraph (trend display)**: Yes
- **Enhanced, much sharper Aaronia LCD display (3d generation)**: Yes
- **Integrated battery charger (supports our optional LiPo battery)**: Yes
- **Internal speaker**: Piezo

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Please continue on next page
APPLICATION EXAMPLES:
1. Integrated electric (E) & isotropic magnetic (H) sensor/antenna
2. ADP1 Active Differential Probe (conductive measurement)
3. Aluminum Tripod (big version)
4. Analyzer Software for MAC-OS, Linux and Windows (on CD)
5. Aluminum carrying case with foam protection
6. Audio output (2,5mm jack)
7. Heavy Plastic Carrying Case
8. Calibration Certificate
9. GEO14 Vibrationsensor (10Hz-1kHz)
10. GEO10 Vibrationsensor (4Hz-1kHz)
11. PBS1 Near Field Probe Set (passive)
12. 20dB Attenuator (offers a higher maximum voltage up to 2V)
13. Pistol Grip / Miniature Tripod
14. Outdoor Rubber Protection (perfect for outdoor usage)
15. Aluminum Tripod (big version)
16. DC-Blocker (protects the input against DC voltage)
17. 20dB Attenuator (offers a higher maximum voltage up to 2V)
18. PBS1 Near Field Probe Set (passive)
19. PBS2 Near Field Probe Set (active, incl. UBBV2 preamplifier)
20. ADP1 Active Differential Probe (conductive measurement)
21. GEO10 Vibrationsensor (4Hz-1kHz)
22. GEO14 Vibrationsensor (10Hz-1kHz)
23. Calibration Certificate
24. Heavy Plastic Carrying Case

Included In Delivery
- Integrated electric (E) & isotropic magnetic (H) sensor/antenna
- SPECTRAN 1300mAh rechargeable battery (integrated)
- Battery charger and power supply incl. international adapter set
- Aluminum carrying case with foam protection
- Detailed English manual (on CD)
- Analyzer Software for MAC-OS, Linux and Windows (on CD)
- SMA tool
- Option UBBV2 (40dB external preamplifier DC-8GHz)

Available Options (extra charge)

**Option 001** (1MB memory expansion) - harddisk
**Option 005** (12Bit DDC for ultra high sensitivity) - installed
**Option 006** (Isotropic static magnetic field sensor)?!
**Option 008** (20MHz expansion. New range: 1Hz-20MHz) - installed
**Option 009** (24Bit resolution for Option 006) - installed
**Option 010** (30MHz expansion. New range: 1KHz-30MHz) - installed

Optional Accessories

- SMA input (f) with high impedance
- USB 1.1/2.0
- Audio output (2,5mm jack)
- Charger plug (max. 15V)
- Jog Dial (easy usage of menu, marker and volume control)
- 1/4” tripod connector
- 3000mAh Lithium Polymer (LiPo) Power-Battery
- Option UBBV2 (6dB external preamplifier DC-8GHz)

Options:
- Option 001: 1MB memory expansion
- Option 005: 12Bit DDC for ultra high sensitivity
- Option 006: Isotropic static magnetic field sensor
- Option 008: 20MHz expansion. New range: 1Hz-20MHz
- Option 009: 24Bit resolution for Option 006
- Option 010: 30MHz expansion. New range: 1KHz-30MHz

Preliminary specifications dated 17.04.2012. Range, sensitivity and accuracy can change depending on frequency, setup, antenna and used parameters. Precision data are based on Aaronias calibration-reference under NF standard: 1MHz. Only with option 001 up to 30MHz. NF standard: 1nT. Only with option 005 down to 1pT. NF standard: 2µV. Only with option 005 down to 200nV. NF standard: 200mV. Only with option 20dB Attenuator up to 2V.
Options for Spectran NF-50xx series

**Option 001: 1MB memory expansion**

**Available for:** NF-1010E, NF-3020, NF-5030, NF-5030S

This memory expansion is a MUST-HAVE particularly when using the data logger, as the standard capacity can quickly become exhausted in this mode. The memory expansion provides space for more than 10,000 logs, while the standard memory will only accommodate approximately 100 of them.

Standard memory size is 64K.

*Order/Art.-No.: 160*

**Option 005: 12Bit Dual DDC frequency filter**

**Already installed in:** NF-1010E, NF-3020, NF-5030, NF-5030X, NF-5030S, NF-XFR

This cutting edge 12Bit DDC frequency filter allows extremely fast, crisp and accurate frequency filtering, while at the same time drastically enhancing the sensitivity. As an example, magnetic fields can (depending on their frequency) still be measured down to 1pT (0.001nT), compared to 0.1nT without the option.

*Order/Art.-No.: 186*

**Option 006: 3D sensor for static magnetic fields**

**Available for:** NF-5030, NF-5030S

This top-grade geomagnetic field sensor provides the ability to conduct geophysical assessments and measurement of geomagnetic field anomalies. However, it can also be used to turn the instrument into a Gaussmeter, measuring the difference between field strengths (static fields) of permanent magnets. Thanks to its ISOTROPIC (3D) construction, measurements can be performed in all three spatial dimensions AT ONCE (or seperately). Sensitivity is about 10nT-600µT.

*Order/Art.-No.: 188*

**Option 008: 20MHz frequency extension**

**Available for:** NF-5030, NF-5030S (inclusive at NF-XFR)

This 20MHz frequency extension option vastly enhances the frequency range of the NF-5030. Amongst others, it brings the ADSL and 13.56MHz RFID frequency bands in range. What's more, we are already developing a PC-based analysis software for decoding RFID.

The maximum frequency range of the NF-5030 without option 008 is 1MHz.

*Order/Art.-No.: 179*

**Option 009: 24Bit resolution for 3D static magnetic field sensor**

**Available for:** NF-5030, NF-5030S

Option 006 provides a significantly higher resolution for the optional 3D magnetic field sensor for measurement of static magnetic fields (option 006); it is ABSOLUTELY mandatory for geomagnetic surveys.

The standard resolution of the NF-5030 without option 009 is 14Bit.

*Order/Art.-No.: 178*

**Option 010: 30MHz frequency extension**

**Available for:** NF-5030, NF-5030S, NF-5030X

Our 30MHz frequency extension extends the frequency range to the absolute maximum. The new frequency range is 1kHz - 30MHz. Amongst others, it even allows measurement of VDSL2. The higher clock frequency of the DDC provided by this option is a MUST HAVE for technicians and authorities needing ACCURATE assessment of signal sources of up to 30MHz. The maximum frequency of the NF-5030 / NF-5030X without option 010 is 1MHz.

*Order/Art.-No.: 179-1*

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Recommended accessories

**Heavy Plastic Carrycase PRO**
Shock resistant, heavy version with padding. Offers spaces for 2 SPECTRAN units with all accessories and a HyperLOG 70xx or 60xx antenna. A MUST for the professional user or outdoor usage!
*Order/Art.-No.: 243*

**Pistol grip / miniature tripod**
Detachable handle with super-practical miniature tripod mode: this handle is attachable to the backside of the unit and allows optimal handling (esp. for directional measurement) and even fixed installation of the unit. STRONGLY recommended for PC use!
*Order/Art.-No.: 280*

**Aluminum tripod**
Height adjustable, high stability. STRONGLY recommended for PC use! Max. height: 105cm.
*Order/Art.-No.: 281*

**Calibration Certificate**
Available for all SPECTRAN® units. With detailed calibration sheet.
*Order/Art.-No.: 786*

**USB Cable (Special Version)**
To connect your Spectran to the PC. Special version with high performance EMC-ferrite. STRONGLY recommended for PC use!
*Order/Art.-No.: 774*

**Protection rubber**
Protect and personalize your SPECTRAN with a sturdy rubber case and keep it scratch-n-dent free. Allows full access to all functions.
*Order/Art.-No.: 290*

**3000mAh LiPo Power-Battery**
Offers a MUCH higher runtime of your SPECTRAN (up to 400%). Strongly recommended for autonomic measurement! The 1300mAh standard-battery will be replaced.
*Order/Art.-No.: 254*

**Car power adapter for mobile use**
With power-LED. For charging batteries or operating our units in your car, including special plug.
*Order/Art.-No.: 260*

**DC-Blocker (SMA)**
It prevents the RF-input of the SPECTRAN to be destroyed by the DC-voltages of f.e. DSL/ISDN lines.
*Order/Art.-No.: 778*

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References

Cross-Section of Aaronia Clients

Government, Military, Aeronautic, Astronautic
- NATO, Belgium
- Department of Defense, USA
- Department of Defense, Australia
- Airbus, Germany
- Boeing, USA
- Bundeswehr, Germany
- NASA, USA
- Lockheed Martin, USA
- Lufthansa, Germany
- DLR, Germany
- Eurocontrol, Belgium
- EADS, Germany
- DEA, USA
- FBI, USA
- BKA, Germany
- Federal Police, Germany
- Ministry of Defense, Netherlands

Industry
- APPLE, USA
- IBM, Switzerland
- Intel, Germany
- Shell Oil Company, USA
- ATI, USA
- Microsoft, USA
- Motorola, Brazil
- Audi, Germany
- BMW, Germany
- Daimler, Germany
- Volkswagen, Germany
- BASF, Germany
- Siemens AG, Germany
- Rohde & Schwarz, Germany
- Infineon, Austria
- Philips, Germany
- ThyssenKrupp, Germany
- EnBW, Germany
- RTL Television, Germany
- Pro Sieben – SAT 1, Germany
- Channel 6, United Kingdom
- CNN, USA
- Duracell, USA
- German Telekom, Germany
- Bank of Canada, Canada
- NBC News, USA
- Sony, Germany
- Anritsu, Germany
- Hewlett Packard, Germany
- Robert Bosch, Germany
- Mercedes Benz, Austria
- Osram, Germany
- DEKRA, Germany
- AMD, Germany
- Keysight, China
- Infineon Technologies, Germany
- Philips Semiconductors, Germany
- Hyundai Europe, Germany
- JDSU, Korea
- Wilkinson Sword, Germany
- IBM Deutschland, Germany
- Nokia-Siemens Networks, Germany

Research/Development, Science and Universities
- MIT - Physics Department, USA
- California State University, USA
- Indonesien Institute of Sience, Indonesia
- Los Alamos National Laboratory, USA
- University of Bahrain, Bahrain
- University of Florida, USA
- University of Victoria, Canada
- University of Newcastle, United Kingdom
- University of Durham, United Kingdom
- University Strasbourg, France
- University of Sydney, Australia
- University of Athen, Greece
- University of Munich, Germany
- Technical University of Hamburg, Germany
- Max-Planck Institute for Radio Astronomy, Germany
- Max-Planck Institute for Quantum Optics, Germany
- Max-Planck-Institute for Nuclear Physics, Germany
- Max-Planck-Institute for Iron Research, Germany
- Research Centre Karlsruhe, Germany

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