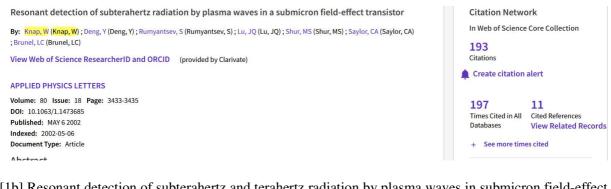
#### 10 Most important publications in the research field of CENTERA-IRA on Terahertz plamonics

#### [1a] Resonant detection of subterahertz radiation by plasma waves in a submicron fieldeffect transistor

Knap, W.; Deng, Y.; Rumyantsev, S.; Lü, J. Q.; Shur, M. S.; Saylor, C. A.; Brunel, L. C., Applied Physics Letters 2002,80 (18), 3433-3435. CITATIONS:193 DOI: 10.1063/1.1473685 https://aip.scitation.org/doi/10.1063/1.1473685



[1b] Resonant detection of subterahertz and terahertz radiation by plasma waves in submicron field-effect transistors

<u>Knap, W</u>.; Deng, Y.; Rumyantsev, S.; Shur, M. S., *Applied Physics Letters* **2002**,*81* (24), 4637-4639.

CITATIONS: 255 DOI: 10.1063/1.1525851 https://aip.scitation.org/doi/10.1063/1.1525851

Resonant detection of subterahertz and terahertz radiation by plasma waves in submicron field-effect transistors

By: Knap, W (Knap, W) ; Deng, Y (Deng, Y) ; Rumyantsev, S (Rumyantsev, S) ; Shur, MS (Shur, MS) View Web of Science ResearcherID and ORCID (provided by Clarivate)

APPLIED PHYSICS LETTERS Volume: 81 Issue: 24 Page: 4637-4639 DOI: 10.1063/1.1525851 Published: DEC 9 2002 Indexed: 2002-12-09 Document Type: Article



First experimental work showing that submicron field-effect transistor (GaAs – HEMT) can operate as plasma wave detector at sub-THz and THz radiation – this means operate as detectors at frequencies. This is first experimental proof of predictions of Dyakonov and Shur plasma wave theory. First experimental work showing that submicron field-effect transistor (GaAs – HEMT) can operate as plasma wave detector of sub-THz radiation – this means operate as detectors at frequencies much higher then their electrical cut-off frequencies. For the first time theoretical predictions of Dyakonov and Shur – has been confirmed. This work opened the future for THz imaging systems based on arrays of nano-transistors.

#### [2] Nonresonant detection of terahertz radiation in field effect transistors

<u>Knap, W</u>.; Kachorovskii, V.; Deng, Y.; Rumyantsev, S.; Lü, J. Q.; Gaska, R.; Shur, M. S.; Simin, G.; Hu, X.; Khan, M. A.; Saylor, C. A.; Brunel, L. C.
 *Journal of Applied Physics* 2002,91 (11), 9346-9353.
 CITATIONS: 341
 DOI: 10.1063/1.1468257
 https://aip.scitation.org/doi/10.1063/1.1468257

Nonresonant detection of terahertz radiation in field effect transistors

By: Knap, W (Knap, W); Kachorovskii, V (Kachorovskii, V); Deng, Y (Deng, Y); Rumyantsev, S (Rumyantsev, S); Lu, JQ (Lu, JQ); Gaska, R (Gaska, R); Shur, MS (Shur, MS); Simin, G (Simin, G); Hu, X (Hu, X); Khan, MA (Khan, MA); Saylor, CA (Saylor, CA); Brunel, LC (Brunel, LC) ...Less

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JOURNAL OF APPLIED PHYSICS Volume: 91 Issue: 11 Page: 9346-9353 DOI: 10.1063/1.1468257 Published: JUN 1 2002 Indexed: 2002-06-01 Document Type: Article

CITATIONS: 341 DOI: 10.1063/1.1468257 https://aip.scitation.org/doi/10.1063/1.1468257



This work presents for the first time complete experimental and theoretical description of plasma wave detection of THz radiation. The work is the basis of the understanding of physical limits of plasma wave rectification in nanostructures. It opens the possibility to interpret results of THz detection experiments on all types of THz plasma wave detectors.

**[3]** Terahertz emission by plasma waves in 60 nm gate high electron mobility transistors **Knap, W**.; Lusakowski, J.; Parenty, T.; Bollaert, S.; Cappy, A.; Popov, V. V.; Shur, M. S.,. *Applied Physics Letters* **2004**,*84* (13), 2331-2333.

CITATIONS: 284 DOI: 10.1063/1.1689401 https://aip.scitation.org/doi/10.1063/1.1689401

This work presents first experimental proof showing that plasma wave oscillations in nano-transistors may lead to THz emission. Work is done in close collaboration with researchers from University of Warsaw

Terahertz emission. by plasma waves in 60 nm gate high electron mobility transistors	Citation Network	
By: Knap, W (Knap, W); Lusakowski, J (Lusakowski, J); Parenty, T (Parenty, T); Bollaert, S (Bollaert, S); Cappy, A (Cappy, A); Popov, VV (Popov, VV); Shur, MS (Shur, MS) View Web of Science ResearcherID and ORCID (provided by Clarivate)	In Web of Science Core Collection 284 Citations	
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Volume: 84 Issue: 13 Page: 2331-2333 DOI: 10.1063/1.1689401 Published: MAR 29 2004 Indexed: 2004-03-29 Document Type: Article	287 Times Cited in All Databases + See more tim	11 Cited References View Related Records es cited

# [4] Plasma wave detection of sub-terahertz and terahertz radiation by silicon field-effect transistors

<u>W. Knap</u>, F. Teppe, Y. Meziani, N. Dyakonova, J. Lusakowski, F. Boeuf, T. Skotnicki, D. Maude, S. Rumyantsev, M.S. Shur, <u>Appl. Phys. Lett.</u> **85**, 675 (2004)

CITATIONS: 262 DOI: 10.1063/1.1775034 https://aip.scitation.org/doi/10.1063/1.1775034

Plasma wave detection of sub-terahertz and terahertz radiation by silicon field-effect transistors By: Knap, W (Knap, W); Teppe, F (Teppe, F); Meziani, Y (Meziani, Y); Dyakonova, N (Dyakonova, N); Lusakowski, J (Lusakowski, J); Boeuf, F (Boeuf, F); Skotnicki, T (Skotnicki, T); Maude, D (Maude, D); Rumyantsev, S (Rumyantsev, S); Shur, MS (Shur, MS)	Citation Network In Web of Science Core Collection 262	
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APPLIED PHYSICS LETTERS Volume: 85 Issue: 4 Page: 675-677 DOI: 10.1063/1.1775034 Published: JUL 26 2004 Indexed: 2004-07-26 Document Type: Article	Create citation 264 Times Cited in All Databases + See more time	18 Cited References View Related Records

# *First demonstration that Silicon transistors can detect THz radiation – even if the carrier mobility is one order smaller that in GaAs HEMTs*

[5] Schuster, F.; Coquillat, D.; Videlier, H.; Sakowicz, M.; Teppe, F.; Dussopt, L.; Giffard, B.; Skotnicki, T.; <u>Knap, W</u>., Broadband terahertz imaging with highly sensitive silicon CMOS detectors. *Optics Express* **2011**,*19* (8), 7827-7832.

Broadband terahertz imaging with highly sensitive silicon CMOS detectors

By: Schuster, F (Schuster, Franz) <sup>[1]</sup>, <sup>[2]</sup>, <sup>[3]</sup>; Coquillat, D (Coquillat, Dominique) <sup>[2]</sup>, <sup>[3]</sup>; Videlier, H (Videlier, Hadley) <sup>[2]</sup>, <sup>[3]</sup>; Sakowicz, M (Sakowicz, Maciej) <sup>[2]</sup>, <sup>[3]</sup>; Teppe, F (Teppe, Frederic) <sup>[2]</sup>, <sup>[3]</sup>; Dussopt, L (Dussopt, Laurent) <sup>[1]</sup>; Giffard, B (Giffard, Benoit) <sup>[1]</sup>; Skotnicki, T (Skotnicki, Thomas) <sup>[4]</sup>; Knap, W (Knap, Wojciech) <sup>[2]</sup>, <sup>[3]</sup>;

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**OPTICS EXPRESS** 

Volume: 19 Issue: 8 Page: 7827-7832 DOI: 10.1364/OE.19.007827 Published: APR 11 2011 Indexed: 2011-04-11 Document Type: Article CITATIONS: 278 DOI: 10.1364/OE.19.007827 https://opg.optica.org/oe/fulltext.cfm?uri=oe-19-8-7827&id=211658

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### This work is the first demonstration of use of Plasma Wave Detectors Based on standard Silicon technology for THz Imaging.

It opens the way for Silicon technology based THZ sensors arrays

[6] Klimenko, O. A.; Mityagin, Y. A.; Videlier, H.; Teppe, F.; Dyakonova, N. V.; Consejo, C.; Bollaert, S.; Murzin, V. N.; <u>Knap, W</u>., Terahertz response of InGaAs field effect transistors in quantizing magnetic fields. *Applied Physics Letters* **2010**,*97* (2), 22111-22111.

CITATIONS: 10 DOI: 10.1063/1.3462072 https://aip.scitation.org/doi/10.1063/1.3462072

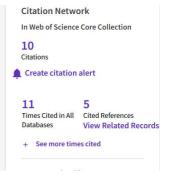
Terahertz response of InGaAs field effect transistors in quantizing magnetic fields

By: Klimenko, OA (Klimenko, O. A.) <sup>[1]</sup>, <sup>[2]</sup>; Mityagin, YA (Mityagin, Yu. A.) <sup>[1]</sup>; Videlier, H (Videlier, H.) <sup>[2]</sup>; Teppe, F (Teppe, F.) <sup>[2]</sup>; Dyakonova, NV (Dyakonova, N. V.) <sup>[2]</sup>; Consejo, C (Consejo, C.) <sup>[2]</sup>; Bollaert, S (Bollaert, S.) <sup>[3]</sup>; Murzin, VN (Murzin, V. N.) <sup>[1]</sup>; Knap, W (Knap, W.) <sup>[2]</sup>

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APPLIED PHYSICS LETTERS

Volume: 97 Issue: 2 Article Number: 022111 DOI: 10.1063/1.3462072 Published: JUL 12 2010 Indexed: 2010-07-12 Document Type: Article



[7] Terahertz radiation detection by field effect transistor in magnetic field,

S. Boubanga-Tombet, M. Sakowicz, D. Coquillat, F. Teppe,; W. Knap, M.I. Dyakonov, K. Karpierz, J. Łusakowski, M. Grynberg,

Appl. Phys. Lett. 95, 072106 (2009)

CITATIONS: 31 DOI: 10.1063/1.3207886 https://aip.scitation.org/doi/10.1063/1.3207886

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Terahertz radiation detection by field effect transistor in magnetic field	Citation Network	
By: Boubanga-Tombet, S (Boubanga-Tombet, S.) <sup>[1]</sup> ; Sakowicz, M (Sakowicz, M.) <sup>[1]</sup> ; <sup>[2]</sup> ; Coquillat, D (Coquillat, D.) <sup>[1]</sup> ; Teppe, F (Teppe, F; <sup>[1]</sup> ; F, <sup>[1]</sup> ; <sup>K</sup> nap, W (Knap, W.) <sup>[1]</sup> , <sup>[2]</sup> ; Dyakonov, MI (Dyakonov, M. I.) <sup>[3]</sup> ; Karpierz, K (Karpierz, K.) <sup>[2]</sup> ; Lusakowski, J (Lusakowski, J) <sup>[2]</sup> ; Grynberg, M (Grynberg, M.) <sup>[2]</sup> View Web of Science ResearcherID and ORCID (provided by Clarivate)	In Web of Science Core Collection 31 Citations Create citation alert	
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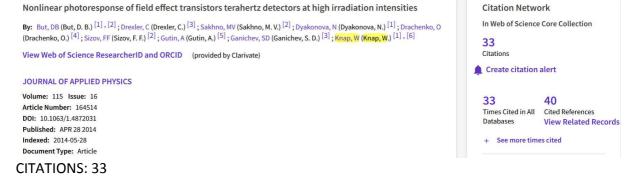
## *These works* [6, 7] *show final – definitive proof that plasma oscillations are responsible for THz radiation rectification in field effect transistors*

[8] Sakowicz, M.; Lifshits, M. B.; Klimenko, O. A.; Schuster, F.; Coquillat, D.; Teppe, F.; <u>Knap, W</u>., Terahertz responsivity of field effect transistors versus their static channel conductivity and loading effects. *Journal of Applied Physics* **2011**,*110* (5), 054512.

CITATIONS: 147 DOI: 10.1063/1.3632058 https://aip.scitation.org/doi/10.1063/1.3632058

Terahertz responsivity of field effect transistors versus their static channel conductivity and loading effects	Citation Network In Web of Science Core Collection	
By: Sakowicz, M. (Sakowicz, M.) <sup>[1]</sup> , <sup>[2]</sup> , <sup>[3]</sup> ; Lifshits, MB (Lifshits, M. B.) <sup>[1]</sup> , <sup>[2]</sup> , <sup>[3]</sup> , <sup>[4]</sup> ; Klimenko, OA (Klimenko, O. A.) <sup>[1]</sup> , <sup>[2]</sup> , <sup>[3]</sup> , <sup>[5]</sup> ; Schuster, F. (Schuster, F.) <sup>[1]</sup> , <sup>[2]</sup> , <sup>[3]</sup> , <sup>[6]</sup> ; Coquillat, D. (Coquillat, D.) <sup>[1]</sup> , <sup>[2]</sup> , <sup>[3]</sup> ; Teppe, F. (Teppe, F.) <sup>[1]</sup> , <sup>[2]</sup> , <sup>[3]</sup> ; <sup>Knap, W</sup> (Knap, W) <sup>[1]</sup> , <sup>[2]</sup> , <sup>[3]</sup> ; <sup>[3]</sup>	147 Citations	
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JOURNAL OF APPLIED PHYSICS	150 Times Cited in All	22 Cited References
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Published: SEP 1 2011		
Indexed: 2011-10-05		
Document Type: Article		

In this work for the first time the relation between static (DC) characteristics of nanotransistors and their high frequency (THz) plasma wave response is established. Both theoretical and experimental research presented in this work establish the basis of data interpretation for all researchers studying THz rectification by plasma wave nonlinearity mechanisms. [9] But, D. B.; Drexler, C.; Sakhno, M. V.; Dyakonova, N.; Drachenko, O.; Sizov, F. F.; Gutin, A.; Ganichev, S. D.; <u>Knap, W</u>., Nonlinear photoresponse of field effect transistors terahertz detectors at high irradiation intensities. *Journal of Applied Physics* **2014**,*115* (16), 164514.



DOI: 10.1063/1.4872031 https://aip.scitation.org/doi/10.1063/1.4872031

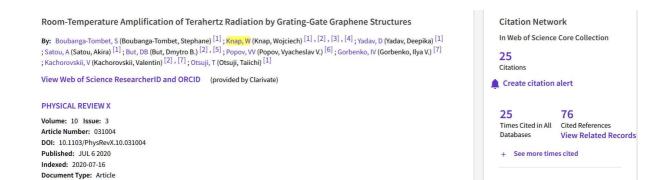
This work presents first experimental studies of the speed and dynamic range of plasma wave THz transistors. It shows high dynamic range and response time below 1ns qualifying these transistors as the best detectors for THz arrays – for THz vison and imaging

[10]Room-Temperature Amplification of Terahertz Radiation by Grating-Gate Graphene Structures,

S. Boubanga-Tombet, <u>W. Knap</u>, D. Yadav, A. Satou, D.B. But, V.V. Popov, I.V. Gorbenko, V. Kachorovskii, T. Otsuji, <u>Phys. Rev. X 10</u>, 031004 (2020)

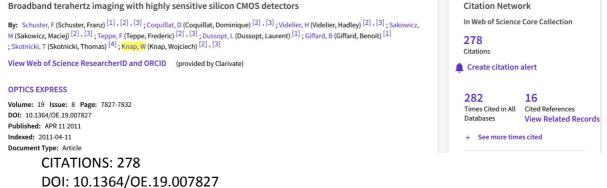
CITATIONS: 25 DOI: 10.1103/PhysRevX.10.031004 https://journals.aps.org/prx/abstract/10.1103/PhysRevX.10.031004

This work is the first demonstration of room temperature THz amplification by plasma waves in grating gate graphene transistors. This result is the basis for the ERC project TERAPLASM currently (2023-2028) realized in the CENTERA LABORATORY – International Research Agenda founded in 2019 by Prof.W.Knap (Institute of High Pressure Physics – Polish Academy of Sciences)



[10] Schuster, F.; Coquillat, D.; Videlier, H.; Sakowicz, M.; Teppe, F.; Dussopt, L.; Giffard, B.; Skotnicki, T.; Knap, W., Broadband terahertz imaging with highly sensitive silicon CMOS detectors. Optics Express 2011,19 (8), 7827-7832.

Broadband terahertz imaging with highly sensitive silicon CMOS detectors



https://opg.optica.org/oe/fulltext.cfm?uri=oe-19-8-7827&id=211658

This work is the first demonstration of use of Plasma Wave Detectors Based on standard Silicon technology for THz Imaging.

It opens the way for Silicon technology based THZ sensors arrays