IHP conducts research and development in the fields of silicon-based systems, highest-frequency integrated circuits, and technologies for wireless and broadband communication. The focus of research at the institute lies in economically relevant issues, resulting in applications for telecommunications, medical engineering, security, aerospace, and automation technologies.

The strength of IHP is evident in the scientific contributions to leading conferences around the world, in the continuous success in attaining third-party funds and the steadily increasing number of international users of its preparation technologies for prototypes and small series. Together with IHP staff’s exceptional professional expertise, the cutting-edge modern technological equipment plays an important role in this success.

IHP provides an important bridge between academia and industry. The Joint Labs with universities and colleges in the Berlin-Brandenburg region have been particularly successful in this cooperation.

Seeing is believing. You are cordially invited to pay us a visit and see the power and potential of the IHP for yourself.

Yours sincerely,

Prof. Wolfgang Mehr
Scientific Director
The Exchange of Information is the Motor of Today’s World

It seems as if the world is spinning at an ever-increasing pace. Distances are shrinking, moments become shorter. When astronauts perform an experiment in space, we can look over their shoulders. When our children are studying in a foreign country, we can easily talk to them. Whether we work in the city, live in a little village, cruise the seas, or race from continent to continent in a jet plane, we do not miss a thing. Information accompanies us. Constantly. Everywhere. Television, computers, internet, and smartphones are our constant companions. We are an integral part of the world and are continuously aware of what makes the other parts move.

A life without this rapid flow of information is no longer imaginable. We depend on the exchange of information for our daily routines, at work, and in our leisure time – and we are already dreaming of ever less complicated and ever faster connections, not only with distant friends and partners, but also with our immediate surroundings.
We Research and Develop Wireless Communication Technologies

If you want to transmit pictures quickly or download a movie in a flash, you need high-speed data transmission. Wireless and broadband communication allow for this speed. IHP is researching and developing silicon-based systems, highest-frequency integrated circuits, and special technologies for these purposes.

IHP’s research is structured vertically. The departments System Design, Circuit Design, Technology, and Materials Research represent competences at various levels of the added-value chain and work together on projects in the framework of a uniform strategy.

One particular strength of IHP is the realization of prototypes and small series with the fast SiGe BiCMOS technologies in IHP’s pilot line.

A long-term goal of the institute is to increase operating frequencies into the terahertz range, from the development and integration of innovative components and integrated circuits to the demonstration of systems for their application.
People, Facts and Figures

Semiconductor research has a long history in Frankfurt (Oder). IHP was founded in the city in 1983. In 1991 it was re-established as a non-university institute in the legal form of a limited liability corporation (GmbH) and included in the so-called “Blaue Liste”, today known as the Leibniz Association.

In 1999 a new institute building was constructed in the Technologiepark Ostbrandenburg. It has more than 7,000 m² of utilizable space and a 1,000 m² class 1 clean-room with a full pilot line. Because of the strong increase in the number of employees due to the many research projects, an extension was built in 2013. More than 300 people from over 20 different countries are employed at the institute. Of these, about 130 are scientists, primarily engineers and physicists. The Scientific Director is Professor Wolfgang Mehr. Manfred Stöcker is the Administrative Director.

IHP receives annual institutional grants of more than 23 million Euros, provided equally by the Federal Republic of Germany and the State of Brandenburg. In addition, the institute obtains funding from national and European research programs and from its cooperations with industrial partners. The extent of this funding has been increasing for many years and has clearly exceeded the mark of 13 million Euros in 2013. Within the framework of investment projects promoted by the ERDF, the institute has been able to modernize and adapt its infrastructure to the requirements of current research projects at the highest level.
High Performance Wireless – We’re Working on It

System Design

Large volumes of information are becoming accessible in any place, all the time. This requires faster and more reliable wireless transmission systems, which consume little energy. That is why IHP is working on systems by which data volumes of more than 100 gigabits per second can be transferred wirelessly over short distances, e.g. software or movies to a mobile device in seconds. In the long run, this is a matter of researching the limits of the achievable rate of transmission.

Other applications, for instance sensor networks, demand devices with an extremely low energy consumption, whose batteries should not require changing for years. Here we are working on intelligent methods for minimizing energy consumption at all levels, from the software to the hardware and from the system to technology.

To obtain broad user acceptance, wireless transmission must be secure and reliable. That is why we are working to constantly further improve our already powerful security processors.
Circuit Design

Analog circuits with highest frequencies, highest data rates, and low power dissipation are the key to new systems for IHP. In order to realize future transmissions with very high data rates, transmitter and receiver circuits with frequencies of 60 GHz to over 245 GHz are currently being developed. Innovatively designed HF-sensors also work in this frequency range and will be applied in bio- and medical technology.

Data transmission via glass fiber is the backbone of communication in the internet and in big data processing centers. The constantly rising amount of data requires ever faster circuits for ever higher transmission rates. Based on the silicon photonics technology of IHP, circuits for complex optical modulation techniques with data rates up to 400 gigabits per second are currently developed.

Battery powered, wireless communications systems are continuously finding their way into the home and industrial environment. This trend will be supported by the development of energy-efficient and thus battery saving radio circuits.
More than Moore – with Focus on Highest Frequencies and High Integration

Technology

Semiconductor technologies are developing in the direction of a further reduction in the size of components as well as towards the integration of additional functions. IHP’s activities are aimed in the second direction, also known as “More than Moore”. The most important group of additional components are the SiGe-heterobipolar transistors, with which IHP is currently attaining frequencies of up to 500 GHz.

The technology will be further enhanced to integrate additional functions and components with even higher frequencies up to the terahertz range. An important aim is the integration of optical and electro-optical components in silicon to realize electronic-photonic circuits.

The institute has a pilot line with 0.25 μm and 0.13 μm SiGe BiCMOS technologies. This line is used jointly for technological developments, numerous research projects with universities and other research institutions and as a service for industrial partners requiring the highest performance for a low number of units.
The Integration of New Materials Overcomes Limits

Materials Research

New device concepts and technologies increasingly demand the use of new materials in microelectronics. To research and integrate these is the main task of IHP’s materials research. The research work is performed in close cooperation with i.e. the technology department.

The focus of interest lies in the control of materials down to the nano level using state-of-the-art analytical methods in order to expand the function range of the IHP BiCMOS technology by means of highly efficient modules for future requirements and new fields of work.

A main emphasis is the integration of mono-molecular carbon coatings (graphene) into CMOS or BiCMOS technologies, especially to increase the frequency up to the terahertz range. A further focus is given by silicon CMOS compatible materials integration for photonics (e.g. germanium light emitters).
Joint Labs

To take better advantage of the basic research done at universities and colleges, part of the basic research is performed in close cooperation with regional university institutions in “Joint Labs”.

The institute has been operating a Joint Lab with the Brandenburg Technical University Cottbus-Senftenberg (BTU) for materials research since 2000 and another one with the University of Applied Sciences Wildau, focused on photonics and new components, since 2006. The Joint Lab of IHP and Technical University of Berlin (TU) was founded in 2010 and aims at the combination of silicon electronics with Optoelectronics in silicon photonics. 2012 saw the latest establishment of two further Joint Labs; one with the TU Berlin on Bioelectronics and another one with the Humboldt-University of Berlin, which will focus on the investigation and development of high-performance wireless communication systems.

Within the frame of the Joint Labs, IHP is devoted to the education of future highly qualified professionals at the partner universities, especially in the Berlin-Brandenburg region, with lectures and jointly conducted Bachelor-, Master- and doctoral theses.
Cooperations and Services

IHP is an important and reliable partner for businesses. Cooperations range from the support of regional companies to the use of IHP know how by small and medium-sized companies to joint ventures with major corporations in the framework of bilateral contracts or national or European joint research projects.

The institute is an attractive partner for the education of high school and university students, offering lectures and internships as well as support for theses.

IHP provides services for industry, research facilities, and universities. For this purpose, the institute’s infrastructure and research results are available. Along with Multi-Project Wafer (MPW) Service & Prototyping or the manufacture of small series production in the pilot line with the IHP’s fast SiGe BiCMOS technology, the institute also provides the transfer of technologies and technology modules, the use of processing steps, analysis, and high-frequency measurements.
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