INSTITUT FOR FYSIK OG ASTRONOMI
DET NATURVIDENSKABELIGE FAKULTET
AARHUS UNIVERSITET

IFA – NYT UGE: 26

IFA inviterer til 25-års jubilæum

Den 4. juli 2009 kan **Grete Flarup** fejre 25-års jubilæum som ansat ved Aarhus Universitet.

Dette vil vi gerne markere ved at indbyde alle medarbejdere til reception **mandag den 29. juni 2009 kl. 14.30** i Fysisk Kantine, hvor Instituttet er vært ved et traktement.

Ruth Laursen

Information fra administrationen

Trykkeri

Den 1. juli 2009 lukker Fakultets trykkeri.
Vi har mulighed for at bruge andre trykkerier efter 1. juli.
I administrationen har vi besluttet at bruge SUN-TRYK:

http://www.svftrykkeri.au.dk/

På hjemmesiden står en vejledning i hvordan I udfylder den rekvisition, der skal skrives og sendes. Det sker automatisk, hvis man bruger Outlook som mailsystem. Bruger man andre mailsystemer, skal man sætte dem op til at det skal være et default mailsystem, så virker det også. Vær opmærksom på at leveringstiden kan være længere end vi er vant til, så husk at fremsende det i god tid. Og det er vigtigt at I – når I udfylder rekvisitionen – HUSKER at udfylde kontostrengen. Der kan I selvfølgelig spørge vores dygtige regnskabsfolk hvad I skal skrive.

I kan også bruge andre trykkerier:

Vester Kopi, Østergade 44, 8000 Århus C
http://www.vesterkopi.dk/sw1521.asp

og Laser Tryk, P.O. Pedersensvej 9, 8200 Skejby
http://www.lasertryk.dk/

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Nye åbningstider i Informationen pr. 1. juli

Den 1. juli er Birthe Møller Christensen bevilget nedsat arbejdstid til 29,6 timer ugentligt. Det betyder at Informationen ikke mere har åbent hele dagen, men efter følgende plan:

MANDAG – TORSDAG	**9.00-14.30**
FREDAG	**9.00-13.00**
LUKKET I FROKOSTPAUSEN	**12.15-13.00**

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Sommerferiedækning i uge 30 i administrationen

I uge 30 vil der ikke være sekretær bemanding i huset, da de alle har ønsket og fået bevilget ferie. Så hvis nogen af jer har brug for sekretærhjælp vil jeg bede jer planlægge det, således at arbejdet kan udføres før eller efter uge 30.

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Ruth Laursen

Lukning af et herre- og et damebaderum i ugerne 31 og 32 (1524-120 - 1524-124 og 1524-128).

Disse baderum kan **ikke** benyttes af **personalet** ved Fysik og Astronomi fra **den 24. juli til den 9. august (begge dage inkl.)**

I ugerne 31 og 32 er der henholdsvis Matematik Camp og Astronomi Camp, og vi har udlånt baderummene hertil.

Længere henne af gangen **1524-112 B** og **1524-112 C** samt ved lagerringen 1526-137 findes der alternative baderum til **damerne**, og **herrerne** kan benytte **1524-132**.

Ruth Laursen

nature nanotechnology

LETTERS

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Direct measurement of electrical conductance through a self-assembled molecular layer

F. Song[1,2], J. W. Wells[1,3], K. Handrup[1], Z. S. Li[4], S. N. Bao[2], K. Schulte[5†], M. Ahola-Tuomi[6], L. C. Mayor[5], J. C. Swarbrick[5†], E. W. Perkins[1,5], L. Gammelgaard[7] and Ph. Hofmann[1†*]

The self-assembly of organic molecules on surfaces is a promising approach for the development of nanoelectronic devices[1,2]. Although a variety of strategies have been used to establish stable links between molecules[2–11], little is known about the electrical conductance of these links. Extended electronic states, a prerequisite for good conductance, have been observed for molecules adsorbed on metal surfaces[12–16]. However, direct conductance measurements through a single layer of molecules are only possible if the molecules are adsorbed on a poorly conducting substrate. Here we use a nanoscale four-point probe[17] to measure the conductivity of a self-assembled layer of cobalt phthalocyanine on a silver-terminated silicon surface as a function of thickness. For low thicknesses, the cobalt phthalocyanine molecules lie flat on the substrate, and their main effect is to reduce the conductivity of the substrate. At higher thicknesses, the cobalt phthalocyanine molecules stand up to form stacks and begin to conduct. These results connect the electronic structure and orientation of molecular monolayer and few-layer systems to their transport properties, and should aid in the rational design of future devices.

Planetary and Space Science 57 (2009) 640–645

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New analysis of the Mössbauer spectra of olivine basalt rocks from Gusev crater on Mars

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Keywords:
Mössbauer spectroscopy
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Mars

A B S T R A C T

The Mars Exploration Rover, Spirit, landed on 4 January 2004, in a lava field in Gusev crater on Mars. Samples interpreted as olivine basalt have been investigated with Mössbauer spectroscopy and chemically with Alpha-particle-X-ray spectrometry (APXS).

In this contribution we present the results of a new analysis of the Mössbauer spectra of selected rock targets in Gusev crater. The results show that the rock surfaces investigated are inhomogeneous, and show strong enhancement of olivine in the surface layer. By subtraction of the surface signal to obtain the spectrum of the true interior of the rock samples, the measurements show the usual correlation between olivine and iron oxides of olivine basalt.

It is argued that the compositional changes observed are related to high temperature oxidation of the rocks, probably during solidification, a process known to lead to anomalously magnetic rocks. The rock Mazatzal is discussed in some detail, and it is suggested that the surface is covered with deposits rich in ferric iron rather than these ferric phases being due to oxidation of the rock. The fact that all the surfaces in this investigation show this same pattern, suggests that the dominating erosion of the surface layer of basaltic rocks at Gusev crater has been mechanical rather than chemical.

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Salten Skov I: A Martian magnetic dust analogue

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ABSTRACT

A fine grained magnetic iron oxide precipitate found in Denmark has been studied with regard to grain size, magnetic properties, aerosol transport, grain electrification, aggregation and optical reflectance. It has shown itself to be a good Martian dust analogue. The fraction of the Salten Skov I soil sample $<63\,\mu m$ was separated from the natural sample by dry sieving. This fraction could be dispersed by ultrasonic treatment into grains of diameter $\sim 1\,\mu m$, in reasonable agreement with suspended dust grains in the Martian atmosphere estimated from the Viking, Pathfinder and Mars Exploration Rover missions. Though mineralogical and chemical differences exist between this analogue and Martian dust material, in wind tunnel experiments many of the physical properties of the atmospheric dust aerosol are reproduced.

hundred m^2 at this site in Mid-Jutland, Denmark. Similar deposits were, however, found at nearby locations (Nørnberg et al., 2004). The origin of these deposits is most likely ferrihydrite precipitated from Fe^{2+} bearing groundwater later transformed into nearly pure goethite, hematite and maghemite, which constitutes almost the entire $<63\,\mu m$ sieved fraction of Salten Skov I.

3. Dust analogue properties

The grain size distribution of the dispersed $<63\,\mu m$ fraction, has been determined by laser diffraction (Fig. 1). This reveals the median of single particles to be ~1 μm. The basic physical and chemical properties have been tabulated (Table 1) and show that the analogue has an in situ field bulk density of 1.1 g/cm^3, which is low for a terrestrial soil, but characteristic for the iron precipitates in this area. It was measured by a volumetric tube. Organic C (carbon content, dry combustion method) is quite high, and the pH (1:1 w/w soil water) is low compared to the groundwater (typically ~7). This is most likely due to organic acids formed from decomposition of forest litter mixed with the material. The dithionite, citrate, bicarbonate extractable iron content (Fe_d, Mehra & Jackson, 1960) is very high compared to Danish soils and only about 10% of this is oxalate extractable (Fe_o, Schwertmann, 1964). With a Fe_o/Fe_d ratio of 0.11 this means that ~90% of the material is well crystallized iron oxides. The extractable aluminium content is very low confirming the origin as a precipitate from neutral groundwater. The total chemical analyses (XRF, Table 2) show a SiO_2 content which is in accordance with the quartz line seen in the XRD (Si is an internal standard, Fig. 2) and a Ti content which is low as expected for chemical precipitates . There is very little feldspar and dark minerals in the sample which is in accordance with the low Al content and low content of FeO. There is a little manganese as expected in this environment and a high volatile fraction due to mainly goethite and organic material. From the XRD and Mössbauer data (Fig. 3) the content of iron oxide mineral fractions have been calculated to be: goethite ~75%, hematite ~19% and maghemite ~6%, which is in accordance with the saturation magnetization of 3.9 (1) Am^2/kg. Using TEM imaging it can be seen that the particles consist of micro crystallites of discrete mineral particles (Fig. 4). Electrical properties experiments on the Salten Skov I dust analogue was carried out in the wind tunnel under Martian conditions. The suspended (2–3 μm) particles have been estimated to carry a net charge of arround 10^5 e (Merrison et al., 2004), which is enough to dominate the processes of adhesion and cohesion causing aggregation of the dust.

4. Comparison to martian dust

The natural bulk density of this Mars analogue dust is close to drift material seen near the Viking 1 landing site (1.2 g/cm^3) (Moore et al., 1987). The Salten Skov I analogue is in grain size close to the results determined on Mars. The Viking and the Pathfinder missions estimated the saturation magnetization to be 1–6 Am^2/kg. However, the latest estimate on the suspended

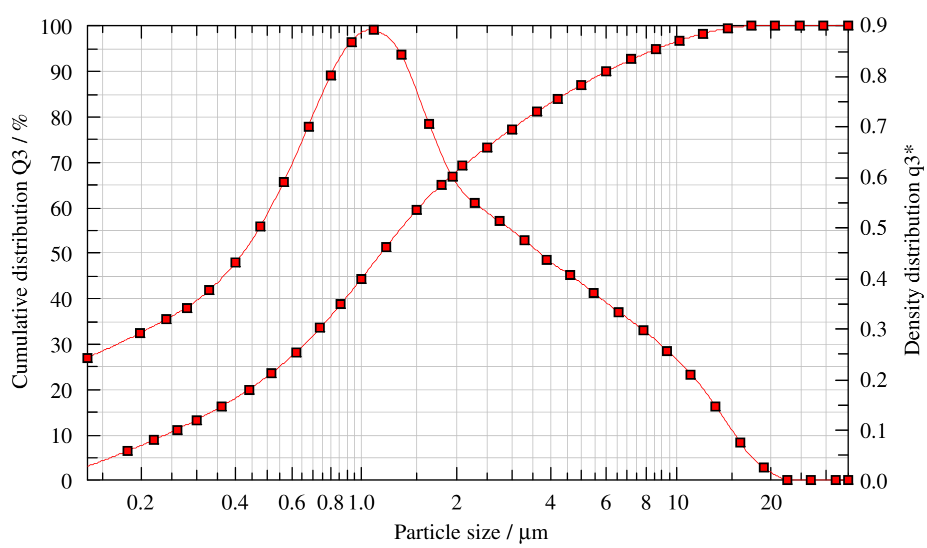

Fig. 1. Particle size distribution of dispersed $<63\,\mu m$ fraction of Salten Skov I. Curves show distribution and accumulated results.

Table 1
Soil chemical data

Depth cm	Sand 2-0.063 mm (%)	Silt+Clay <0.063 mm (%)	Bulk dencity (g/cm^3)	Org. C (%)	pH H_2O	Fed <63 μm	Feo <63 μm	Ald <63 μm	Alo <63 μm	Feo/Fed <63 μm
0–20	64.5	35.5	1.1	5.68	4.59	30.8	3.49	0.48	0.09	0.11

Table 2
Total chemical composition of dust analogue (wt%)

SiO_2 (%)	TiO_2 (%)	Al_2O_3 (%)	Fe_2O_3 (%)	FeO (%)	Mn_3O_4 (%)	MgO (%)	CaO (%)	Na_2O (%)	K_2O (%)	P_2O_5 (%)	Volatiles (%)	Sum (%)
16.10	0.29	3.20	60.46	1.46	1.66	0.16	0.20	0.19	0.52	0.47	14.43	99.15

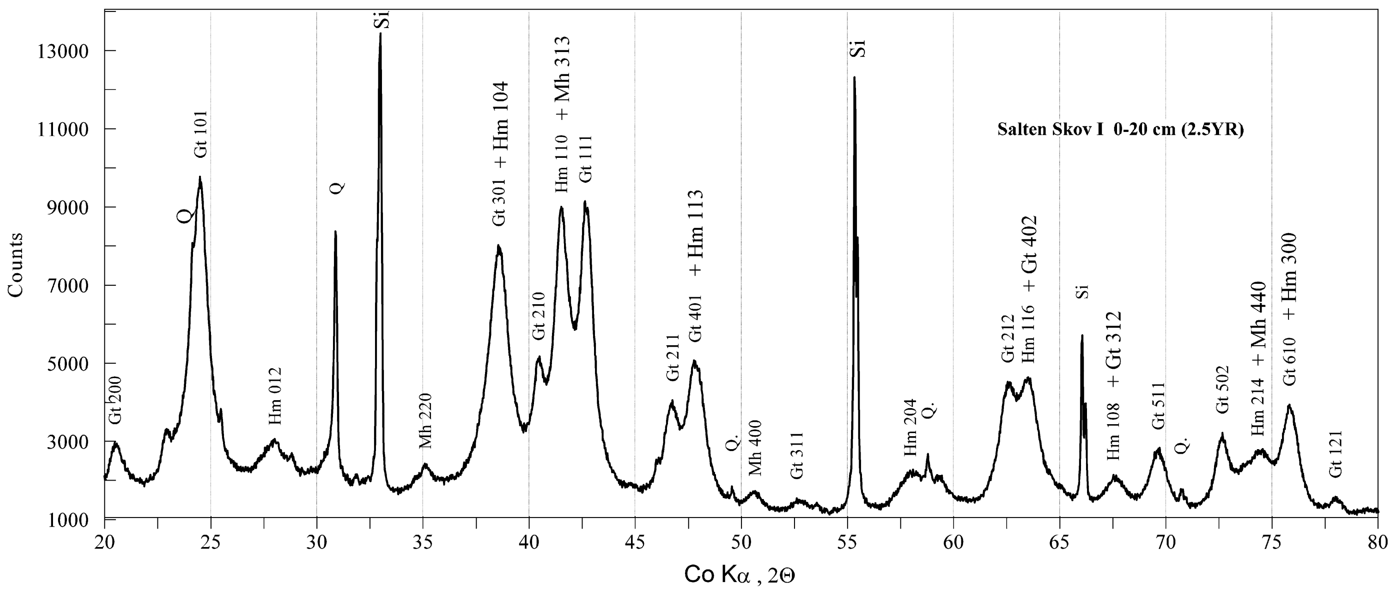

Fig. 2. X-ray diffractogram of Salten Skov I (Co Kα).

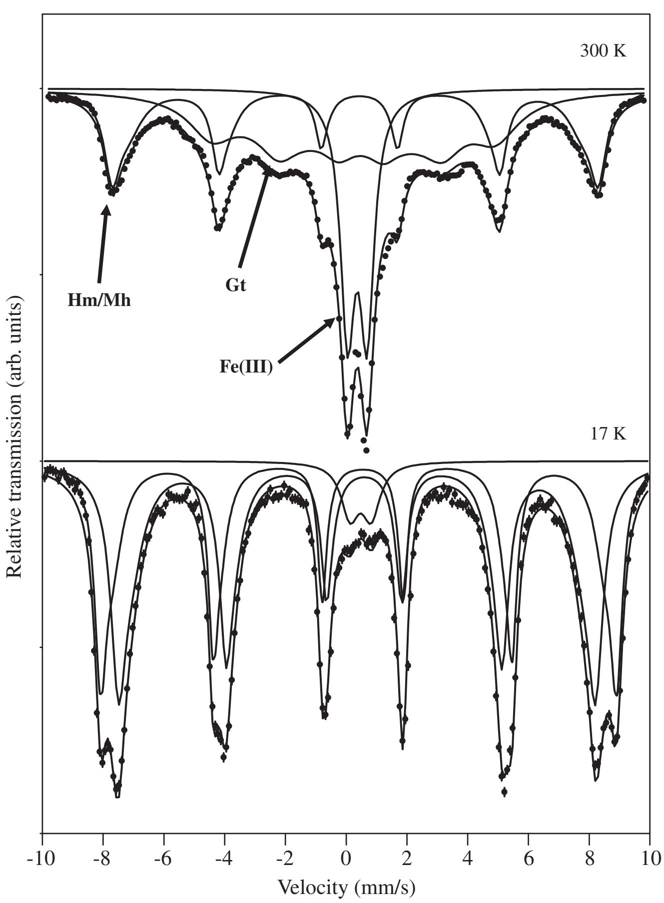

Fig. 3. Mössbauer spectra of Salten Skov I aquired at the temperature indicated. Fitted components are labeled.

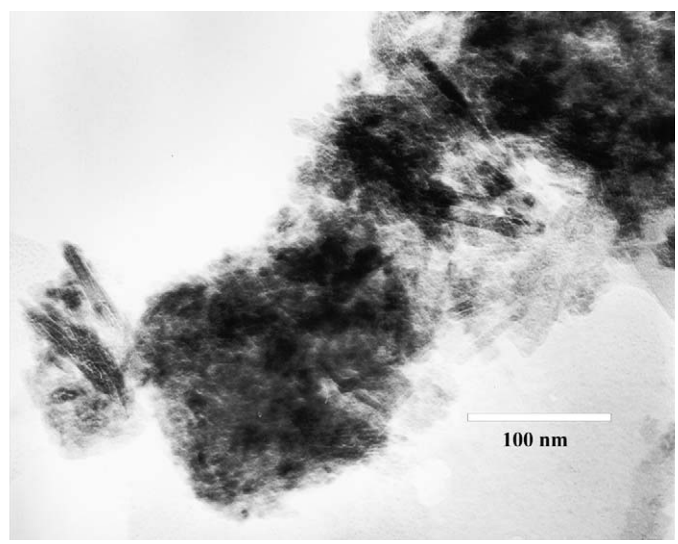

Fig. 4. TEM micrograph of composite particle from Salten Skov I.

Martian dust is ~2 Am^2/kg (Bertelsen et al., 2004) and compared to this the analogue saturation magnetization is somewhat higher, although many factors such as dust grain (aggregate) size, mass density and wind flow conditions could also affect such estimates (Kinch et al., 2005). The chemical analyses from Pathfinder gave an iron content of ~22% Fe_2O_3 (Foley et al., 2003) which is much lower than the content of the analogue dust. So far the APXS data of dust from the 2004 rover magnets are not calibrated. The data taken on the ground in the Gusev Crater include both a mixture of dust and solid rock material and analyses on the rock material after RAT treatment (Gellert et al., 2004). The results without cleaning the rock show a significantly higher content of salt components (SO_3 and Cl) which indicate that the dust minerals are mixed with salts. The FeO content is about 17% and there is no trace of either higher Fe content or lower Ti content from dust on the un-cleaned rock, which might be expected if the dust was a precipitate. The APXS spectra of the capture magnets on both rovers even indicate that the Fe content in the dust is lover (Goetz et al., 2005). However, these are results from non calibrated peak areas and possibly not sufficiently reliable to give a precise iron content. This may also be compared to results form the Mössbauer spectra of the Gusev soil and rock. They show a considerable part of the samples being primary minerals. However, the Fe^{3+}

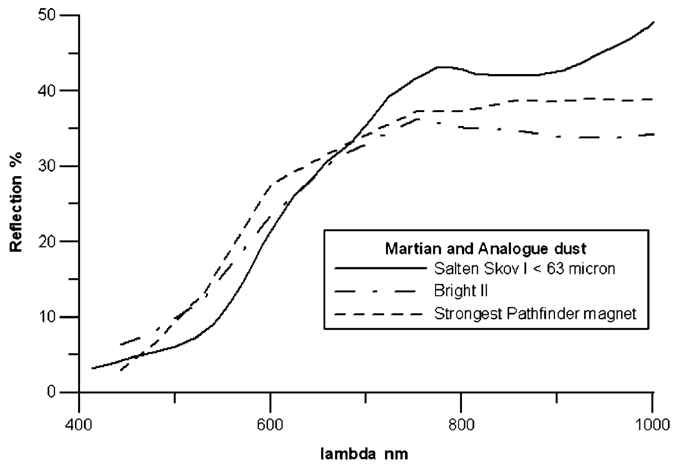

Fig. 5. VIS and near-IR spectra of Martian dust and analogues.

component, which is interpreted as a weathering product of the primary minerals, is highest in the undisturbed surface soil (Morris et al., 2004), indicating a higher iron content in the dust. According to Goetz et al. (2005) the most likely magnetic phase in the dust is oxidized or substituted magnetite, and not pure maghemite as in the Salten Skov I analogue. The visible near-IR spectrum of the Salten Skov I analogue show visible characteristics similar to the Bright II and the Pathfinder magnetic dust (Fig. 5) (Bell III et al., 2000). The reflectance is stronger in the near IR region and most likely related to hematite around 860 nm. This is in accordance with magnetically captured material on the MER Spirit magnets (Bertelsen et al., 2004; Kinch et al., 2005). The absorption line (~860 nm) is relatively stronger from the "capture" magnet due to higher field strength than the "filter" magnet, thus indicating higher hematite fraction. Concerning the structure of the Martian dust, aggregates similar to those seen in the dust coverage of drift material in the Gusev crater (Herkenhoff et al., 2004) are also seen in wind tunnel experiments (Merrison et al., 2002). This suggests that similar processes of electrification and cohesion may occur in analogue and Martian materials (Merrison et al., 2004). This also supports the suggestion that dust aggregation is important to the aeolian transport of dust on Mars (Merrison et al., 2007).

5. Conclusion

Though there are strong chemical differences to Martian dust, this iron oxide precipitate mixture appears so far to be a very good Martian dust analogue regarding grain size, magnetic properties, similarity in optical reflectance, and aggregation properties for application in wind tunnel and other dust suspension/deposition studies.

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DEPARTMENT OF PHYSICS AND ASTRONOMY

PhD DEGREE

Candidate:	**Anne Ivalu Sander Holm**
External examiners:	Peter B. O'Connor, University of Warwick Mark A. Johnson, Yale University
Internal examiner:	Aksel S. Jensen, University of Aarhus
Supervisors:	Steen Brøndsted Nielsen and Preben Hvelplund, University of Aarhus
Public Defence:	Monday, June 29, 2009 at 10:15 Physics Auditorium, Department of Physics and Astronomy
Topic:	**Bare and Solvated DNA and Peptides.** ***Spectroscopy and Mass Spectrometry***

The thesis is available for inspection in room 1520-523

Værkstedskursus

Der afholdes tegne- og værkstedskursus i uge 33 og uge 34 2009. Kurset varer en uge, i alt 37 timer. Der er denne gang plads til 4 deltagere på hvert hold. Kurset vil kun blive afholdt med min. 3 deltagere. Ved bekræftelse på tilmelding bedes du henvende dig til Torben Hyltoft på værkstedet 2. sal for at få udleveret kursusmateriale.

Tilmeldingsliste er fremlagt i informationen
Mandag den 22. Juni kl. 9.00

Eventuelle spørgsmål kan rettes til:
Torben Hyltoft tlf. 3755

Workshop Training Course

Workshop training and technical drawing courses are planned for weeks 33 and 34 2009. The individual course runs for 1 week, in total 37 hours. Maximum 4 participants this time and minimum 3 participants per week to run the course. When participation is confirmed, please contact Torben Hyltoft from workshop 2. floor. Course materials will be delivered.

Registration form on the desk in the information area
Monday, 22 June at 9:00

Questions may be put to:
Torben Hyltoft tlf. 3755