Stuttgarter Physikalisches Kolloquium

Fachbereich Physik, Universität Stuttgart
Max-Planck-Institut für Festkörperforschung
Max-Planck-Institut für Intelligente Systeme

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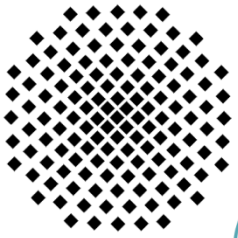

Dienstag, 24. November 2015	17:15 Uhr	Hörsaal V 57.01

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Christmas bakery: delicious soft, hard and glassy matter physics

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Abstract

No matter in which culture, great religious feasts lead to opulent sweets and high level bakery art work resulting in cakes, cookies and other sweet delicious confectioneries. Star shaped cinnamon biscuits (Zimtsterne, “cinnamon stars”) almost everywhere in the world, Panettone in Italy, Stollen in Dresden, sugar pretzels or the classical Hefezopf (“mit einem Haufen Butter drin”) define a class of sugar based foods with exceptional sweet taste, but very different mouth feel. Obviously the composition and ingredients of these different products are very different. Panettone is based on water, flour, sugar and yeast, which yields bread like, elastic and foamy structures. Biscuits, “cinnamon stars” and other short breads form crispy, brittle and “glassy” textures.

In this talk the different “universality” classes of bakery products will be considered from a simple physical point of view. Proteins, water, starch and granular materials, such as ground nuts and almonds, form different kinds of dough, based on simple molecular properties. Wheat flour and water form viscoelastic elastic dough materials which can be widely deformed without rupture. Short bread and cookies based on granular materials form brittle semi-solid doughs, Swabian Springerle undergo a rubber – glass transition (and hopefully back right in time).

The role of the sugar, apart from its culinary function as sweetener, is essential for the physics of the different systems. In Panettone and other spongy sweet yeast buns sugar binds water and keeps moisture during baking and longtime storage. In short bread and cinnamon stars it forms together with proteins (wheat or egg white) glasses after drying (“baking”) between the granules.

A special construction is the Dresdner Stollen, which contains a very high amount of fat (butter), because of which its dough forms a very special emulsion. Additionally, fat dissolves aroma compounds, crystallizes partly after baking and melts in the mouth, which is part of the very fine and melting type texture, but also takes part on the formation, diffusion, and storage of distinct aroma compounds.

The central message of the talk will be a unified view of the dough based on the different functions of its basic ingredients proteins, starch, water and fat, where sugars provide fine tuning on local scales – especially in Christmas bakery.