UNIVERSITY OF WASHINGTON
SEATTLE, WASHINGTON 98195

Department of Physics, 98195-351560 *Fax: (206) 685-0635*
e-mail: dennijs@phys.washington.edu *Tel: (206) 543-7305*

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Dr. Yves Brun,
Systems Biology/Microbiology Faculty Search,
Department of Biology,
Indiana University, Jordan Hall 142, 1001 E 3rd
Street, Bloomington, IN 47405-7005

It is a great pleasure to write on behalf of Chen-Shan Chin in support of his application for a junior faculty position. I know Chen-Shan very well. He performed his graduate research under my guidance and received his PhD in the Spring of 2002.

Without any doubt Chen-Shan is the best of the seven PhD students who received their degree with me. Only Hyunggyu Park comes close. Hyunggyu is nowadays professor of Physics at the Korean Institute of Advanced Studies in Seoul and plays an important leadership role in the Korean statistical physics community. Chen-Shan is truly exceptional. During his PhD, he showed excellent analytical and numerical skills, and above all, displayed leadership and a good sense of what projects are interesting (and those that are not worth pursuing) and a good intuition on how to approach and advance projects.

Chen-Shan is a fast and determined learner. One example of this relates to his language skills. As native of Taiwan it was not surprising that Chen-Shan's English was marginal when he entered our graduate program, but within a few years he learned to communicate very well in English, both verbally and in his writing, and became one of the sought after TA's in our department. He will be an excellent teacher.

After his PhD, Chen-Shan took a postdoc position in bioinformatics. Chen-Shan had several attractive postdoc offers within conventional theoretical physics but turned those down. This was a deliberate and well considered choice, an excellent one.

Scientific research is an ongoing dialogue between fundamental and applied research. Physics remains at this time the bearer of fundamental theoretical issues but the applications that guide such research are shifting away from solid state devices and surface science (as in metal surfaces) towards in particular, nano technology (carbon based) and complexity in regulatory networks (biological, social, and electronic ones). My statistical physics research is focussed on fundamental issues, like the properties of stationary states in complex stochastic driven processes, but the platforms in which these processes find realizations and motivation are shifting rapidly towards biological systems. As I tell my 14 year old daughter, "In the 21st century, Physics will teach you how to think but biological type research is what you will want to do." Chen-Shan's physics background therefore suits him well in his current research.

Chen-Shan's PhD research was about so-called KPZ surface growth. This is a stochastic model for a growing surface, or a moving interface (like in paper combustion or a solid-liquid interface). The interface is rough and scale invariant, and its scaling dimensions are universal in the sense that its large scale properties are independent of the details of the microscopic rule that implement the process. Somewhat like computer software that should appear identical at the time and length scales relevant to the user irrespective of whether at the microscopic level the CPU is Intel or Motorola based. That takes a lot of computer software design. However stochastic processes like interface growth self organize themselves into such universal macroscopic states. Complex networks such as the internet are also believed to self organize themselves into scale free universal states. In how far biological regulatory networks have such properties is a fundamental issue.

Chen-Shan's first PhD project addressed stationary state skewness in KPZ growth. Skewness means that the third moment of the height distribution of the surface is non-zero, and that in the stationary state, hill tops are less sharp than valley bottoms (or the other way around) at all length scales (i.e., even with increasingly blurred vision). Chen-Shan performed a numerical study, using the so-called RSOS and BCSOS discrete lattice model representations, to check whether in two dimensions the KPZ stationary state is skewed, and the amplitude ratio's of the moments are universal (independent of the detailed microscopic model). The answers are yes and we were the first to determine the values of these universal amplitude ratio's. We published this in Phys.Rev.E.

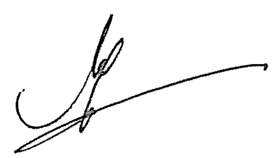
A second aspect of that same project was to resolve the large spread in the published values of the stationary state surface roughness critical exponent α. Its value should be $\alpha = 2/5$, but the spread in numerical values was much larger than would have been acceptable in e.g., equilibrium critical phenomena a few decades ago; for the BCSOS model they were off by about 10%. It turns out that nobody had done a careful finite size scaling (FSS) analysis. We resolved the issue by demonstrating the presence of large amplitude FSS corrections, and we determined for the first time the critical exponent of the leading irrelevant operator in 2D KPZ growth.

Chen-Shan's second PhD project concerned reconstructed rough phases during growth. It is generally accepted that growing surfaces are always rough. So the issue whether a surface can be reconstructed during growth needs to be addressed in the context of reconstructed rough phases. I showed earlier that a surface in thermal equilibrium can indeed be rough and simultaneously be reconstructed (with a definite order parameter and spontaneously broken symmetry). This opens the prospect of a dynamic order-disorder reconstruction type phase transition during growth. Chen-Shan performed a Monte Carlo study for the driven non-equilibrium case. The results were surprising. The reconstruction domain walls obtain an upward bias during surface growth. They are nucleated in the valley bottoms and then run and grow uphill along the surface slopes, until they become trapped at the ridge lines of the KPZ surface. There they remain, slaved to the KPZ fluctuations, only able to disappear when the entire (closed loop) ridge line vanishes by KPZ fluctuations or when a new domain wall is nucleated out of that same valley. The nucleation process dominates at large length scales, implying that at a mathematical level reconstruction order does not exist, but at small length scales (which can still be large compared to experimental system sizes) the KPZ fluctuations dominate and give rise to reconstruction order with quasi-critical fluctuations (powerlaw type diffraction peaks) reflecting KPZ scale invariance. This research was also published in Phys.Rev.E.

Chen-Shan's third and final project was initiated by himself and carried out independently from me. Guided by the trapped domain walls on the two dimensional KPZ surface he studied the scaling properties of a passive random walker on a one dimensional KPZ surface. This walker also runs up-hill and gets trapped. For one, this allowed Chen-Shan to measure the KPZ dynamic exponent directly by Monte Carlo simulations from the fluctuations of the walker. This was a completely novel idea. Secondly, the generalization to many walkers with an $A + A \rightarrow A$ type merging rule, exposes the river like structure of merging ridge lines in the 1D surface as function of time. Chen-Shan published this in a single author paper in Phys.Rev.E..

Chen-Shan is very gifted and highly qualified. He has the leadership capabilities, communication skills, and the insight and motivation to run a strong research program. I expect him to go very far.

Yours Sincerely



Marcel den Nijs

Professor of Physics